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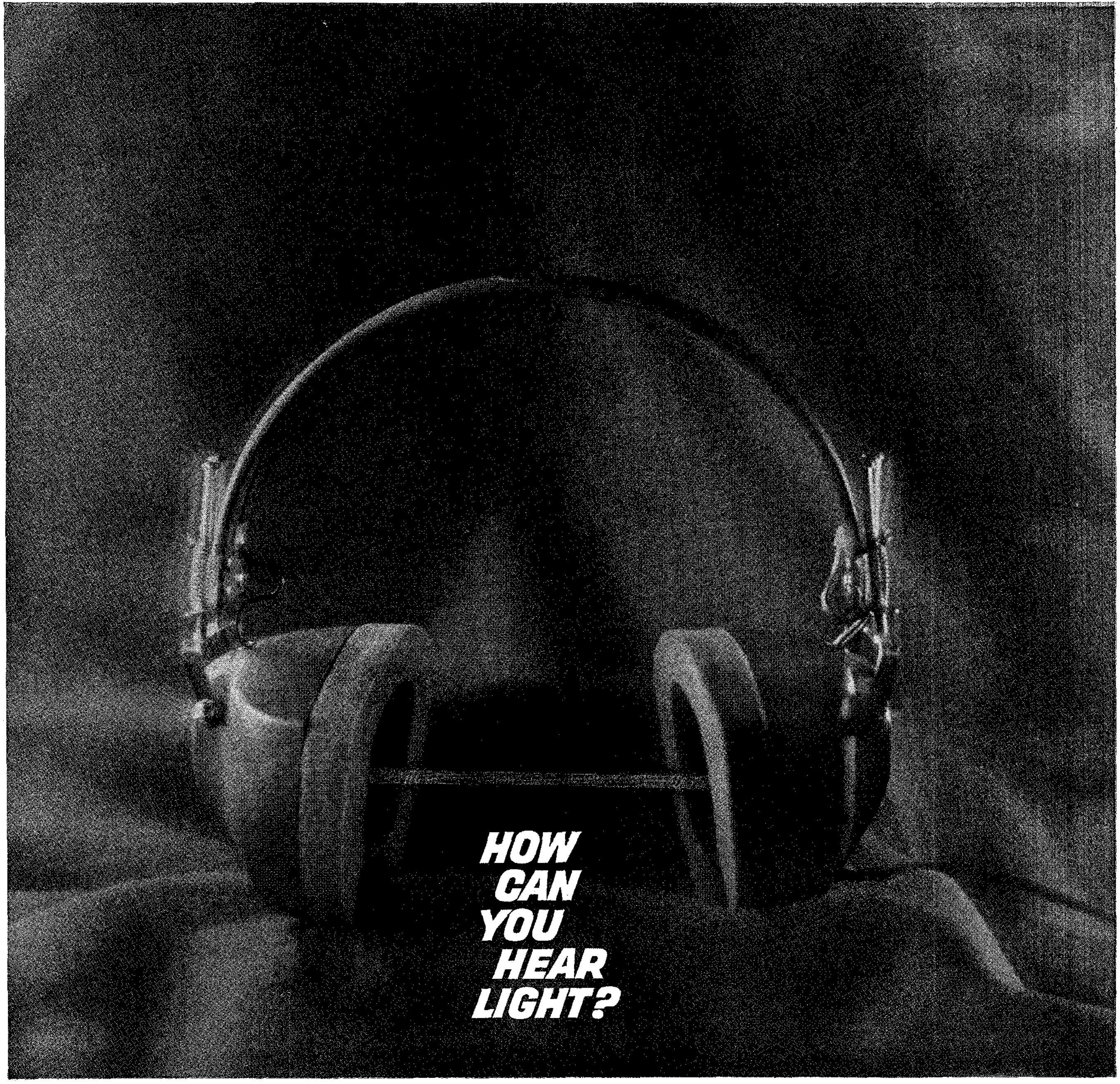
SCIENCE FACT ⟶ SCIENCE FICTION

THE PERMANENT IMPLOSION | BY DEAN McLAUGHLIN

A TALE OF A SCIENTIFIC EXPERIMENT THAT WENT WRONG



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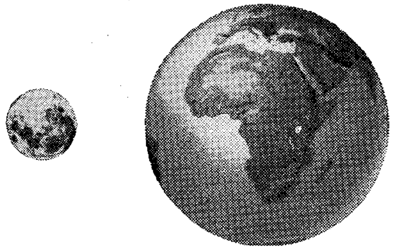

NEW HOPE FOR UNDER-DEVELOPED NATIONS RESULTING FROM BASIC SPACE RESEARCH

Lunar and space missions such as Project Apollo seldom seem, in their far-out glamour role, to be closely related to that great fundamental...mankind. Yet one single aspect of the Apollo program —fuel cells—holds a vast amount of hope. Especially for under-developed nations.

Often referred to as "continuous batteries," fuel cells convert chemical energy directly to electrical. They are the newest power sources to emerge from scientific research into the realm of practical engines. The specific cell system aboard Apollo will be a Hydrox® unit, reacting hydrogen and oxygen, and is the result of research at Leesona Moos Laboratories, one of the first in America to undertake studies on fuel cells. Hydrox will supply electrical power for vehicle control, communications, and numerous other power needs aboard this lunar mission. Marking the first such use of these new power sources, the Hydrox installation will inaugurate a new age in the generation of electrical power. Final engineering and manufacture of the units for Project Apollo will be carried out by Pratt & Whitney Division of United Aircraft, under license from Leesona Corporation.

But space missions are only the first part of the story. At the same point in time that Leesona Moos began studies of Hydrox fuel cells, a concomitant project was undertaken to develop an even more advanced system...a cell using air as oxidant and inexpensive hydrocarbons or their derivatives as fuels. These hydrocarbon-air (Carbox®) and mixed-gas/air (Aminox™) developments of Leesona Moos do not require reactants of high purity, and are very flexible from a logistics point of view. Low cost and readily available fuels are used, and the universal oxidizer—air—supplies the other portion of the reaction mix. Because the fuel cell is an extremely efficient engine—efficiencies of up to 70% are attainable, vs. 30% for a conventional diesel—the result is an exciting new means of generating electrical power at low operating expenditure. Pratt & Whitney Aircraft in the United States, and Energy Conversion Ltd.,* of England, are carrying out further developmental engineering on these systems under license from the Leesona Corporation.

These new Leesona power sources, of high efficiency and low fuel costs, can readily be seen to provide the world with an entirely new type of electric generator. Fuels of the hydrocarbon variety are fairly abundant throughout the world. The fuel cell, though scientifically sophisticated, is neither unwieldy nor complex in its operation, and requires little maintenance. Units with power levels from those required for a one-family dwelling up to communal or industrial ground-power stations have been projected in Leesona Moos studies, and found feasible.

The impact Carbox and Aminox can have on the emerging countries is readily understandable. The development of a nation can almost be measured by its ability to produce and consume electrical power. In this mechanized world, virtually all industry waits on the availability of electricity. If an emergent economy must hold off its development until completion of large-scale hydroelectric projects, a distinct problem of time and expenditures arises. If, on the other hand, the nation had access to Carbox and Aminox type fuel cell systems, which could be tailored to the need and would operate on locally available fuels, the basic first step toward an industrialized economy and higher living standards would be achieved.

Leesona believes its efforts, plus the great additive capabilities of our United States and international partners, will soon result in working installations of the Carbox and Aminox systems to advance the standards of all mankind. Meanwhile, the sibling Hydrox system supplies power for a moon voyage. And research continues.

◆

**Energy Conversion, Ltd., is a new corporation founded by four British companies: National Research and Development Corporation; British Petroleum Company, Ltd.; British Ropes, Ltd., leading manufacturer of rope and steel cable; and Guest, Keen, and Nettlefolds Group, major steel manufacturers.*

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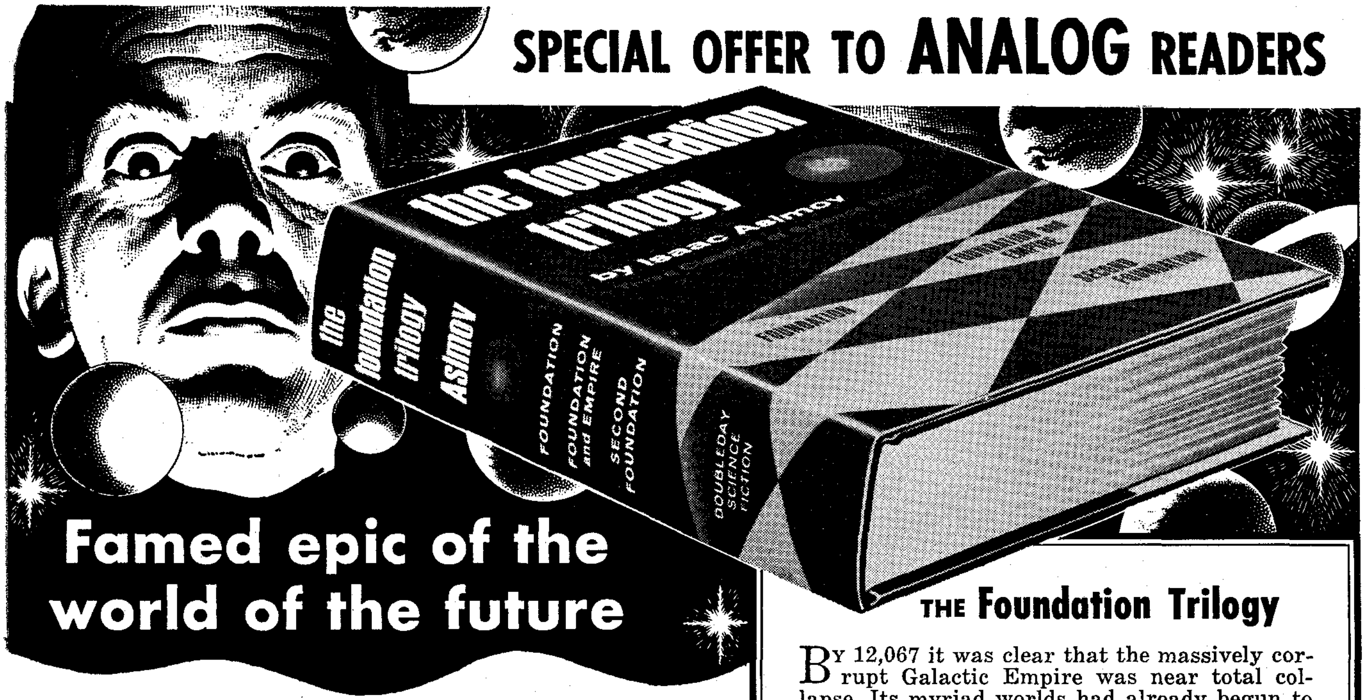
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SCIENCE FACT

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COVER BY JOHN SCHOENHERR

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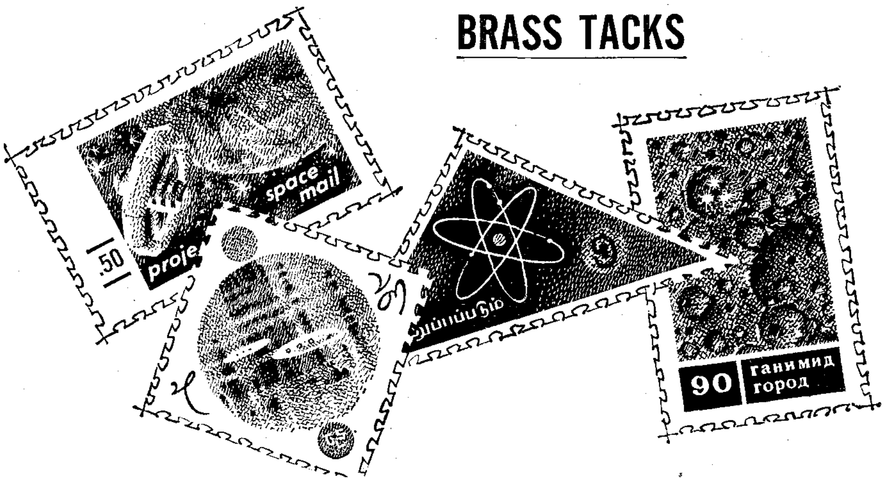


Dear Mr. Campbell:

Your segregation editorial was very interesting but, I am afraid, you have made a serious error. You have violated the First Law of Liberalism which states that all things must be subjected to ruthless scientific examination but no conclusions are to be reached which conflict with the prevailing orthodoxy.

I hope that you have a deep shelter handy as the Lysenkos of Liberalism will soon be coming down upon you like a ton of bricks.

ROBERT E. BEGY

1420 Milton Road, Apt 6,
Alton, Illinois.

Sir, I dislike Orthodoxy in any area! When an orthodoxy holds tenets that are a direct menace to the welfare of the human race, the culture, or the nation—let the bricks fall where they may!

Dear Mr. Campbell:

Photograph Number Seven in your Editorial "UFO" appearing in November's Analog looks very much like a sloppy, inverted shot of a Boeing 727 three-jet passenger kite. Boeing-Renton has cranked out quite a few of these craft. As far as I know, the only other ships of this nature are Douglas DC-9 and the British DeHaviland Trident; neither of these are yet operational, although Boeing's 727's are constantly aloft in the Seattle area.

Tell you what: If I'm wrong, bill me for a two-year subscription to Analog. If I'm correct, you are to obtain and read a copy of Tom Sugrue's "There is a River," a biography of the late Edgar Cayce, to let me know what gimmick, if any, Cayce used in his readings. How does this grab you, sir?

And just so you don't sell the mutton chop-whiskered gentlemen of 1893 short, remember that they discovered the existence of the jet stream in August of 1883, when smoke from Krakatoa was observed over Australia a few short hours after the explosion in Sunda Strait. The British Royal Society published the details.

CHARLES T. LORE

425 S. W. 120th Street,
Seattle 66, Washington.

My local "flying cross" expert claims it's the French Caravelle. He had the advantage of studing the prelouse-up 35 mm negative, however.

Edgar Cayce's gimmick was very simple. It's easy when you have true clairvoyance!

Dear Mr. Campbell:

Enjoyed your editorial in the November issue of Analog about U.F.O. I believe you asked for identification of one of the pictures. My identifications are as follows:

1. Super Constellation Model G
2. High-wing monoplane of light plane variety such as Taylorcraft, Cub, et cetera. (Cessna)
3. Constellation again probably Model G

4. Agree, birds
5. & 6. Again high-wing monoplane as #2
7. Is a Caravelle Jet airplane—probably United Air Lines as only company flying same in this country (upside down)
8. I would guess no matter how large you enlarged the picture as shown, you wouldn't see the plane as it is out of the picture. Many times the condensation trail doesn't develop for some hundred feet behind the engines. Even when flying one or two thousand feet below a jet one can only begin to see the contrail condensing some hundred feet behind the plane although a half to one mile back the trail is quite large (50′ in diameter). One interesting fact at close range, not always seen but many times, is that the trail is made up of millions of small smoke rings with a wisp of condensation between them. Sometime the trail expands quite large and other times remains small.
9. Convair 990—probably American Air Lines.
10. Appears the only false photography in the bunch. Would guess a model or drawing of some delta wing type airplane, but know of no delta wing craft flying today like this one.

I fly DC-8 airplanes for United Air Lines. Captain on DC-8 for two-and-one-half years and for United twenty-one years. Have enjoyed your magazine off and on—mostly on—for twenty-seven years.

F. F. Conley

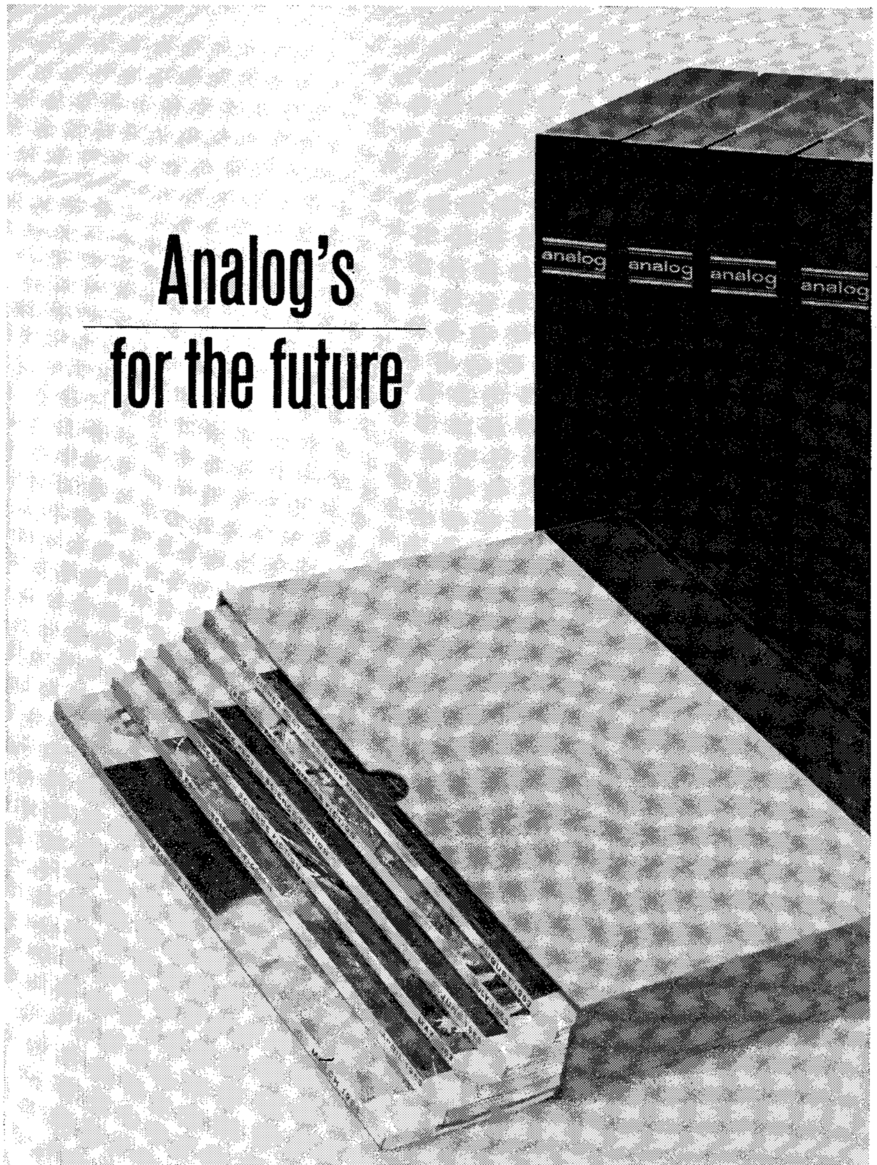
20644 Martinez Street,
Woodland Hills, California

Give him a score of .90—and a large raspberry for missing #10! That last one represented the inevitable hoax, of course—and the good old conventional October 31st. Character seen from below instead of from the side!

Dear John:

There are a couple of items this time that warrant your dark attention. One

(continued on page 90)



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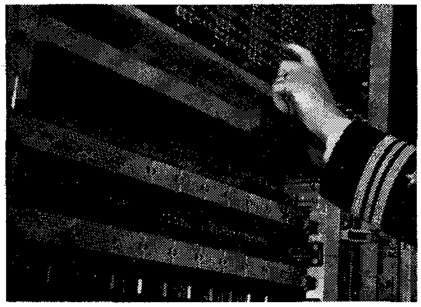
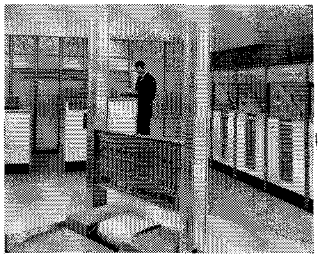


This computer system has been called "the most trouble-free piece of electronic gear in the U.S. Navy today."

Quick! What company makes it?

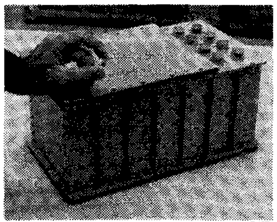
1.



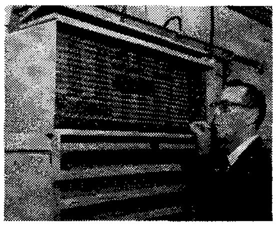
FORTRAN II was fine as far as it went...but FORTRAN IV and this thin-film computer take it farther than first thought possible: cut compiling time up to 90%.

Quick! What company offers both advanced hardware and software?

2.



This is the only microelectronic aerospace guidance and control computer with metallic thin-film memory.



This is the only large-scale, general-purpose military computer with metallic thin-film memory.

Quick! What company makes them?

3.

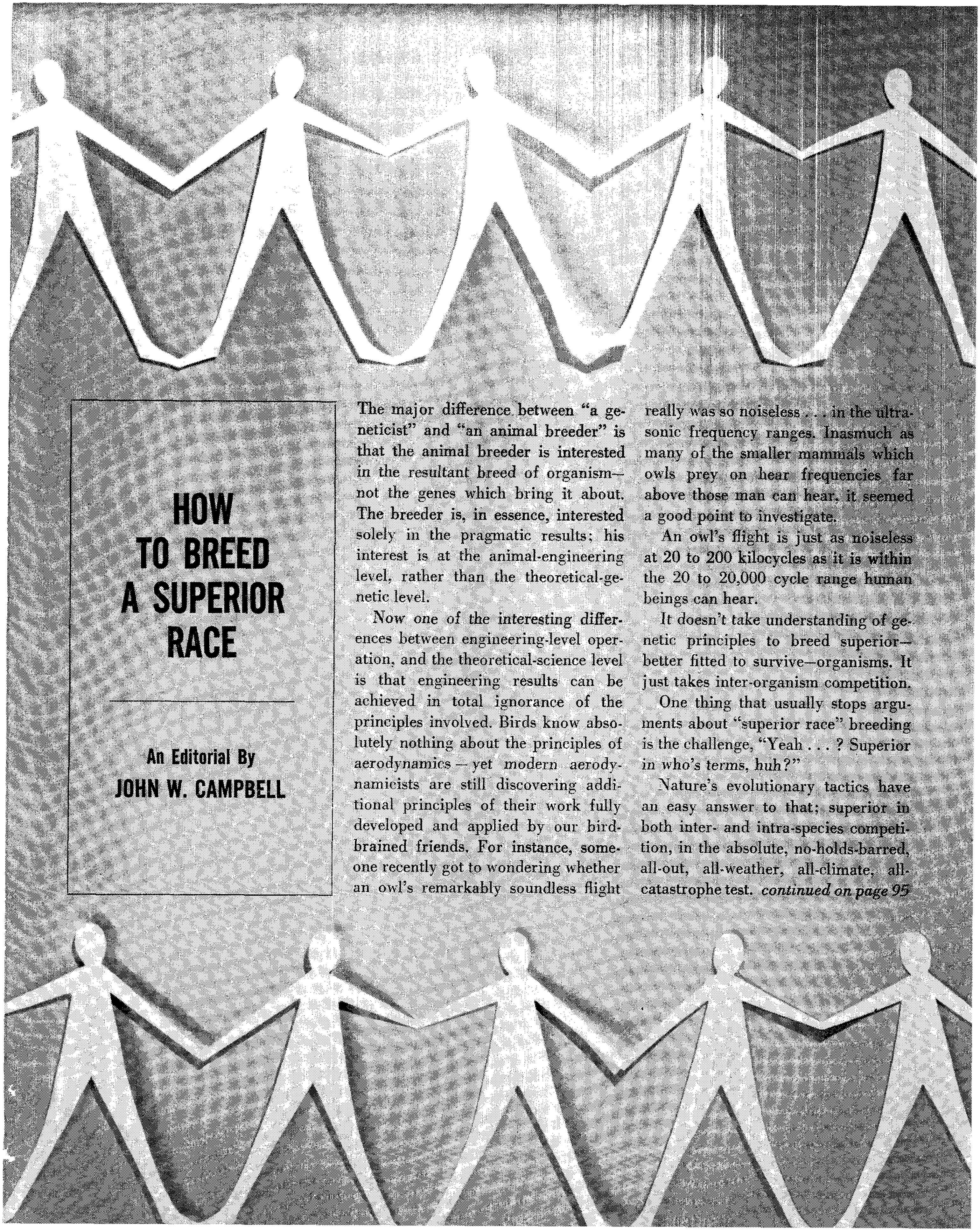
This Target Intercept Computer controls the Nike-Zeus anti-missiles launched from Kwajalein Island

Quick! What company makes it?

4.

UNIVAC DIVISION OF SPERRY RAND CORPORATION

The answer to all four questions, in one word: UNIVAC. If you wish to learn more about any of these new developments, please indicate your specific interest to: Mr. R. A. Bertley, UNIVAC, Division of Sperry Rand Corporation, Sperry Rand Building, New York 19, New York.



HOW TO BREED A SUPERIOR RACE

An Editorial By

JOHN W. CAMPBELL

The major difference between "a geneticist" and "an animal breeder" is that the animal breeder is interested in the resultant breed of organism—not the genes which bring it about. The breeder is, in essence, interested solely in the pragmatic results; his interest is at the animal-engineering level, rather than the theoretical-genetic level.

Now one of the interesting differences between engineering-level operation, and the theoretical-science level is that engineering results can be achieved in total ignorance of the principles involved. Birds know absolutely nothing about the principles of aerodynamics—yet modern aerodynamicists are still discovering additional principles of their work fully developed and applied by our bird-brained friends. For instance, someone recently got to wondering whether an owl's remarkably soundless flight really was so noiseless . . . in the ultrasonic frequency ranges. Inasmuch as many of the smaller mammals which owls prey on hear frequencies far above those man can hear, it seemed a good point to investigate.

An owl's flight is just as noiseless at 20 to 200 kilocycles as it is within the 20 to 20,000 cycle range human beings can hear.

It doesn't take understanding of genetic principles to breed superior—better fitted to survive—organisms. It just takes inter-organism competition.

One thing that usually stops arguments about "superior race" breeding is the challenge, "Yeah . . . ? Superior in who's terms, huh?"

Nature's evolutionary tactics have an easy answer to that; superior in both inter- and intra-species competition, in the absolute, no-holds-barred, all-out, all-weather, all-climate, all-catastrophe test.

continued on page 95

The proposal that major meteor impacts can splash terrestrial rocks into deep space — the space capsules that could spread life through the galaxy — appeared here in June 1962. Now Dr. Hall investigates more carefully exactly what can be expected when primary giant meteors strike planets.

SECONDARY METEORITES

Ralph A. Hall, M.D.

Part 2—The Results

We propose to discuss the results of an impact of a primary octahedrite two kilometers in diameter at twenty kilometers per second. The crater would be twenty-six kilometers in diameter and thirteen kilometers deep. The reactions going on in this pit are large, hot, 1,600,000° F., high-pressure, fast and mainly: mixed. Three-thousand-billion metric tons of rock and dirt will be removed from this pit. Much of it will be powdered and pounded down and under the edge of the brim. The primary sphere of explosion will push back the atmosphere to the height of twenty kilometers. Inside this sphere all substances will be moving out and up at a high rate of speed. We know that fragments of iron can survive, unchanged, a complete reversal of velocity. If we can believe our eyes, a much more fragile fragment in the form of carbonaceous material can survive a one-way blast from standing to solar orbital motion.

On approaching the problem of secondary meteorites we expect to explain a morphology which differs wildly from all known terrestrial formations. That is, all known terrestrial formations that have not been subjected to a meteoric blast. At the same time, we must not forget that there are eighteen other obvious targets that may differ markedly from all known terrestrial formations from the outset.

In trying to visualize the mode of formation of the secondary meteorites there are certain factors to be kept in mind. If a substance is a good conductor, it is more completely affected by heat. If a substance is compressible, it is less affected by a shock wave. Cold-solid-to-solid and solid-through-solid reactions will take place. Certain basic principles will apply. Reconstituting plasma will provide a motive force with high *brisance*. Plasma will also manifest penetrating effects similar to cosmic rays.

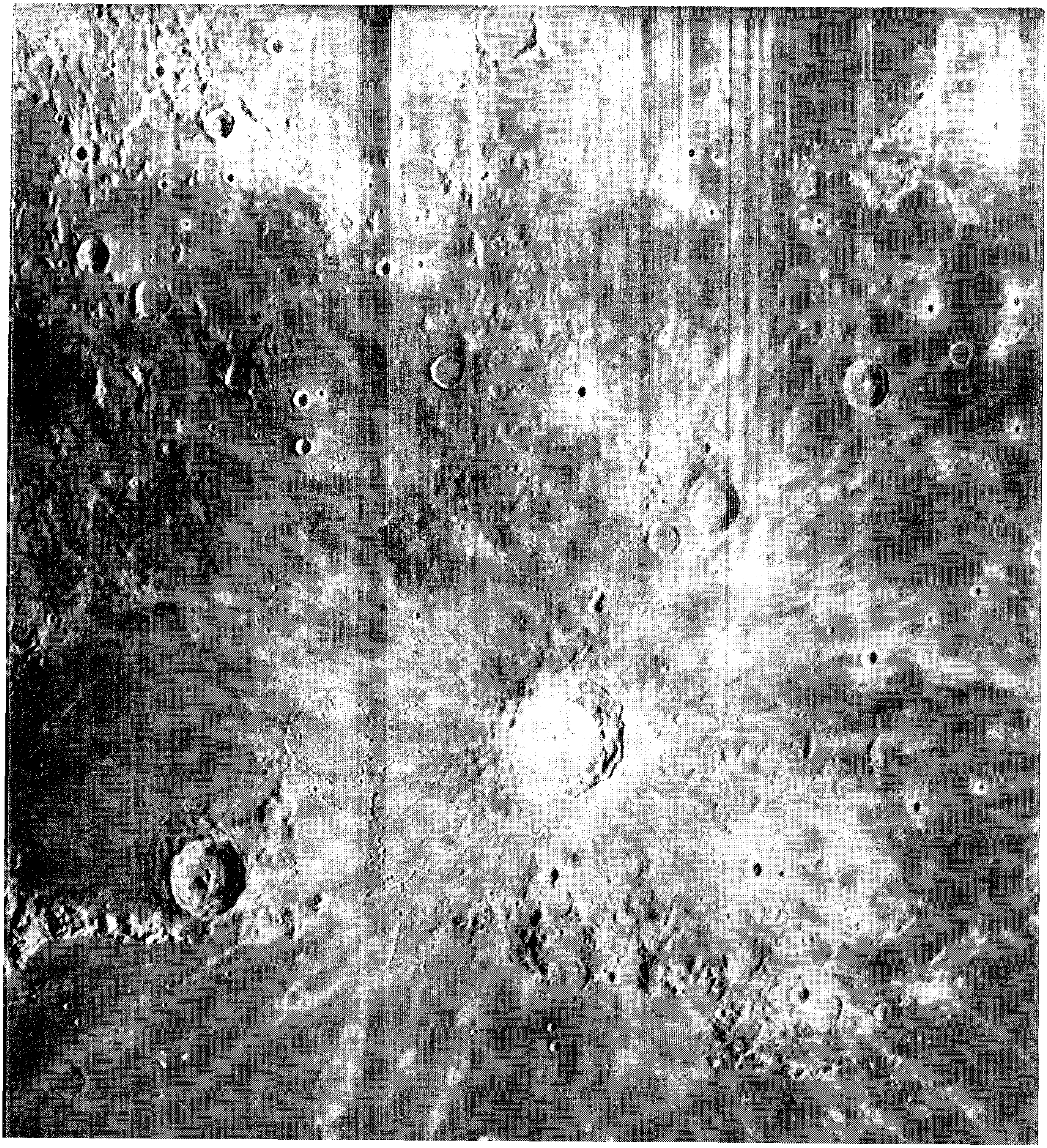
Whenever a heavy meteorite falls, there is a statistical distribution of the speeds of the secondary fragments. In some instances the secondary fragments may travel faster than the primary. In this case, especially where there is no atmosphere, the secondary will go into greater orbit than the primary.

The layers of the Earth—and perhaps any solar body—are related by oxidation, hydration, flotation. The environs of an impact area are reducing, dehydrating, and volatilizing.

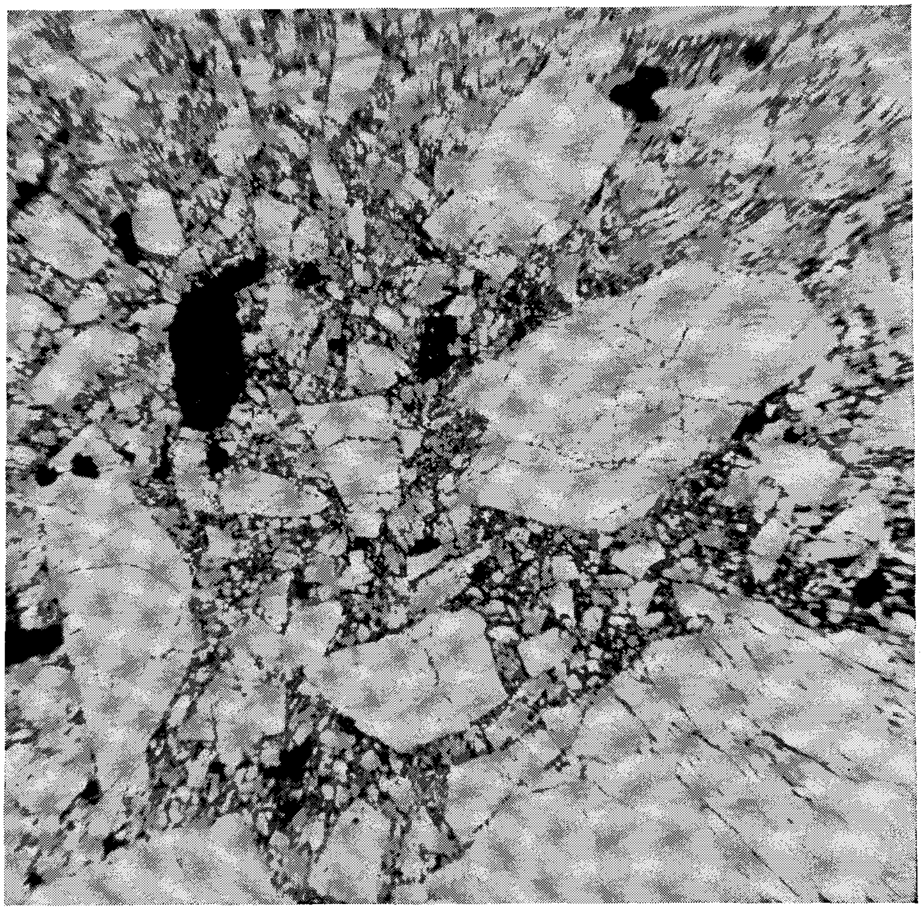
Chondrites currently constitute eighty-two per cent of the group suspected of being secondary meteorites. A chondrite is a stony meteorite with chondrules, a word that comes from the Greek meaning grain. On examining an intact chondrite one sees an irregular smooth surfaced stone with characteristic shallow depressions suggestive of thumbprints. These depressions are formed by shaping blasts of air as the stone made its re-entry into the atmosphere. The surface itself is a fusion crust, which is generally no more than an eighth of an inch thick.

The temperatures involved in re-entry penetrates only the exterior of the stone, something like a baked

Our finest witness of meteoric impacts is the Moon. This is a picture of Copernicus, a meteorite crater 56.7 miles in diameter and 3,300 feet deep. This is recent enough to demonstrate its ray pattern. Irregular heat altered fragments of nickel-iron are also found in a ray pattern around the Barringer Crater. On the surface of the Moon they would remain in untarnished condition for eons. Polarized light studies strengthens this possible explanation. The scraggly line of tiny pits to the left of Copernicus about halfway to the next crater is probably due to explosion of secondary fragments around fifty meters in diameter against a raised wrinkle ridge which can be traced above and below this line of holes. These explosion pits would indicate that many fragments from Copernicus were traveling in excess of four km/sec which is more than the 2.4 km/sec escape velocity of the Moon. Those fragments not stopped by the ridge went on into orbit around the Sun as secondary meteoroids.

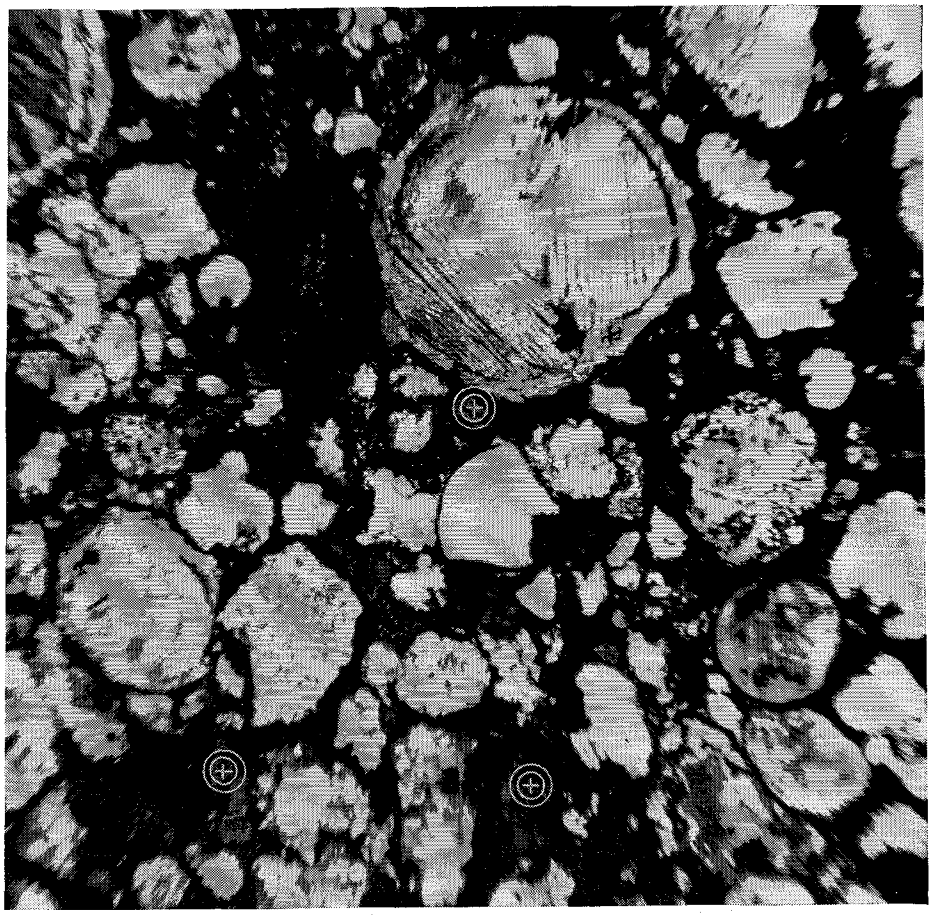


SECONDARY METEORITES



SECTIONS LOANED BY THE AMERICAN MUSEUM OF NATURAL HISTORY PHOTOGRAPHED BY AUTHOR.

Norton, Norton County, Kansas, fell Feb. 18, 1948 at 4:56 P.M., C.S.T. This is an achondrite consisting of aubrite with some nickel-iron inclusions. A shower of stones fell over a considerable area in the county. Over one hundred stones have been recovered, including one of about a ton. This is the largest known stony meteorite and the largest observed fall. Aside from the nickel-iron inclusions, this section looks very much like the results of Morton and De Carli's experiment with a 4.5 km/sec shock wave at 250 kilobars.



Selma, Dallas County, Alabama, is a 310 pound olivine-bronzite chondrite found in 1906. It possibly fell 9:00 P.M., July 20, 1898 when a large luminous meteor was seen. The structure consists of spherules and brecciated fragments of orthopyroxene and olivine imbedded in a glassy amorphous material, spiced with ragged fragments of nickel-iron and triolite. Though the meteorite was exposed to the weather only eight years, much of the nickel-iron is hydrated to limonite. (Three nickel-iron fragments indicated.) Though the melting point of the iron is 300 to 400 degrees centigrade higher than that of the silicates, it is shaped to the silicates and obviously cooled last! Where the age of the iron has been determined with respect to the age of the silicates, the iron is 800 thousand years younger than the silicates. This suggests that the iron was blasted into the substance of the meteorite in a molten state. A meteoric explosion fits the evidence.

Alaska. The high temperature effects found inside the stone are from a previous incident. A stone that was seen to fall on a hot July afternoon, after leaving a blazing smoke trail over Wisconsin, was soon covered with frost from the humid air. The penetration of the atmosphere is accomplished in seconds, and the heat conductibility of even irons is not sufficient to affect the internal temperatures to any notable degree.

If this fusion crust is broken, a tufaceous ashen gray, somewhat more friable, interior is revealed. Imbedded in the tufaceous material are the chondrules which are usually about a millimeter in diameter.

Glass is a universal constituent of chondrites. It varies in color from clear to almost black, but is usually brown. The chondrules are glassy beads with crystalline elements imbedded in them. Microscopic examination of these chondrules suggest strongly that they crystallized from outside inward. Between the chondrules imbedded in and shaped to the tufaceous material are many irregularly shaped nickel-iron fragments, so many, in fact, that the chondrites react vigorously to a magnet. The crystalline silicate chondrules, whose melting points lie between 1,310 and 1,430° C., and metallic grains intermingled with angular fragments of the same silicates, filled the interstices between the chondrules. Yet these metallic grains whose melting point is above 1,500° C. have plainly been the last ingredients to solidify as shown by their relation to the silicate matrix. Nothing could more clearly testify to the fact that the nickel-iron was injected under high pressure as a liquid or condensing gas. Other evidence, such as tiny nickel-iron spherules about a tenth of a millimeter in diameter, indicates that the metal condensed from a gaseous form. This fits nicely with the concept of the blown up meteorite adjacent to a granite-like bedrock.

Another feature common to many meteorites is the veined morphology. These veins have the same average composition as the rest of the rock and also is identical to the fusion crust. These veins indicate that the rock was subjected to through and through heating. This is in agreement with a severe shock wave—which we sometimes forget—cause extreme heating. A rock subjected to an acceleration that will boost it into orbit will be subjected to an annealing heat due to the shock wave that will course through it. As it passes through the explosion blast and heads into orbit, it will be subjected to intense treatment by metallic vapor at several hundred thousand atmospheres pressure. A vapor at such a pressure will penetrate the finest pores. Indeed, a plasma at such pressures will seemingly pass through a solid substance without disturbing its structure. Solid to solid and solid through solid interactions would simplify many explanations of meteoric morphology.

Under these conditions of reduction and dehydration, the order of mineralization will be downgraded. There will be simplification of the variety of minerals in that the process of diversification would be reversed. Only the most primitive high-pressure minerals, such as olivine, hypersthene, and enstatite would separate out under these conditions.

As the stone, a tiny lump the size of an automobile, starts its trip through the atmosphere of the primary blast, it would find itself accompanied by material traveling in the same direction. Hot gases traveling at even greater speeds, would accelerate the stone as well as treat it. Once the stone has traversed the boundaries of the primary blast, it has only the thin resistance of the upper atmosphere to overcome. This final portion of its trip would subject it to a light sear, sealing the package for its extended tour through the solar system and perhaps even the galaxy.

On the other hand, it may return in say eighty-thousand to ninety-million years. On its re-entry twenty to eighty per cent of its substance would be ablated.

Witnesses discribing the re-entry talk about the bright center core surrounded by an aura a hundred times the diameter of the core. The extreme temperatures of the plasma building in front of the meteorite will radiate X rays. The X rays will ionize the air, which in turn will conduct electrons. We know now that electrons released from a plasma will cause fluorescence by causing cascading electronic effects in the surrounding air. The speeds of these reactions are that of lightning. Therefore, their effects will precede and surround the intruding object relatively as though it were standing still.

The plasma building up before the moving stone and around it would cause the nearly instantaneous auditory electromagnetic effects described by witnesses as a buzzing airplane. The meteoric speed in excess of sound by several factors would cause sonic booms which would follow the buzzing noise. As the rock fractured and divided, variations in this sonic boom would result. This witnesses might report as detonations. It has been thought that these stones arrive with intense pent-up internal stresses which were released when the outer layers of the rock were peeled off by the ablative processes. Our later day understanding of transonic speeds may suggest this newer interpretation by sonic booms.

Be that as it may, fragments of the central bolide are dropped along its blazing and smoky course. Once the fragments are stopped by the frontal shock wave, their blaze is extinguished, usually while still a number of miles above the soil. They then fall freely under the influence of the Earth's gravitational field. Few fragments will travel much farther than the final burst of light at the end of the trail. The final burst could be a spraying of the irregular fragments, as the flat surfaces of the fracture plane, against the air and sail the pieces in several directions. This enlarged sonic boom could be the explanation of what has previously been reported as an explosion.

Nonetheless, if you are standing near where these fragments fall, you may be aware of a swishing noise like that of an artillery shell as it comes tumbling through the air. If it is spinning at a high rate, there will be a humming noise. If it hits your house or garage, a few shingles or clapboards may fly. If it passes through several ceilings and bounces on the floor and hits your wife as she lies on the sofa, she will suffer a bruise on her thigh. (Mrs. Hodges, Sylocauga, Alabama, 1954)

News of the "fireball" will bring scientists and collectors from near and far. An occasional prominent student of meteorics will appear with cash in his fist, offering to buy the rock. If you won't sell it—and you'll have to display real pagan resistance not to do so—he'll talk you into loaning it to him. Other people will climb all your fences and search your neighbors' property for other pieces. Those that are not found will disintegrate in fifty years. Every new fragment will be cheered and talked over. Every piece will be bid for. More charitable persons will donate them to the scientists. These pieces will be carefully labeled and logged as to exact location of the find. Thereafter they will be weighed and written description will be made for careful storing. Color, specific gravity, magnetic properties, hardness and pictures will all be recorded by sects of scientific priests, each intoning their separate doctrines as they minister onto the stone. Dogmas will be spoken in firm convincing voices. New theories will be elucidated in piping voices by brash intruders who are unafraid to bare their näiveness.

Next, when the money becomes available, come the dissections and analysis. The meteorite will be sliced into paper thin pieces and mounted on glass slides to be sent to several museums and universities. Meager pieces will be subjected to chemical analysis. Powders will be scanned by X rays. All the results will be written down.

The written report is the life blood of science. No matter how astute the observer, he is not a scientist unless he makes a report. No person is allowed to dismember or analyze any portion of a meteorite unless he writes a scholarly article to be published or privately passed from hand to hand.

The paper-thin slices on glass slides are a handy way to study the microscopic morphology of the meteorites. These are studied with transmitted, reflected and polarized light. For certain effects, both transmitted and reflected light is used. Beautiful colored pictures can be taken. One was reproduced on the cover of the January issue of this magazine.

To get the proper perspective of the chondrites with relation to the other types of meteorites we include here Prior's classification of the meteorites. The table has been inverted and modified to suit our purposes. The numbers after each class are numbers of specimens represented.

TABLE III: CLASSIFICATION OF METEORITES AS TO MINERAL CONSTITUTION

Group	*Class*		*Principal Minerals*
PRIMARY			WIDMANSTATTEN PATTERNS
IRONS	Hexahedrites	55	Kamacite
	Octahedrites	487	Kamacite, Taenite
	Ni-rich Ataxites	36	Taenite
STONY-IRONS	Pallasites	40	Olivine, Nickel-iron
	Siderophyre	1	Orthopyroxene, Nickel-iron
	Lodranite	1	Orthopyroxene, Olivine, Ni-Fe
SECONDARY			NO WIDMANSTATTEN PATTERNS
	Mesosiderites	22	Pyroxene, Plagioclase, Ni-Fe
CHONDRITES	Enstatite	11	Enstatite, Nickel-iron
	Olivine-bronzite	900	Olivine, Bronzite, Nickel-iron
	Olivine-hypersthene		Olivine, Hyperthene, Ni-Fe
	Carbonaceous	17	Serpentine, Magnetite
ACHONDRITES	Aubrites	9	Enstatite, (Ni-Fe, Triolite)*
	Diogenites	8	Hypersthene, (Ni-Fe = 1%)
	Chassignite	1	Olivine, (Ni-Fe)
	Ureilites	3	Olivine, Pigeonite, Ni-Fe
	Angrite	1	Augite
	Nakhlites	2	Diopside, Olivine, (Magnetite)
	Eucrites, and Howardites	39	Pyroxene, Plagioclase (Ni-Fe in some)

**Parentheses means trace amounts*

To examine the mounted specimens in detail we can inspect them with a microscope. With ten magnifications the usual one millimeter chondrule appears to be a centimeter in diameter. One is impressed by the matrix of homogenous material in which the formed elements are imbedded. Various authors describe the chondrules as fused drops of fiery rain; spherical crystals in a turbid isotropic material; and beads frozen in a melt. Everywhere is the ubiquitous iron; Nickel-iron in the chondrites and achondrites. Magnetite is found in other achondrites and carboniferous meteorites.

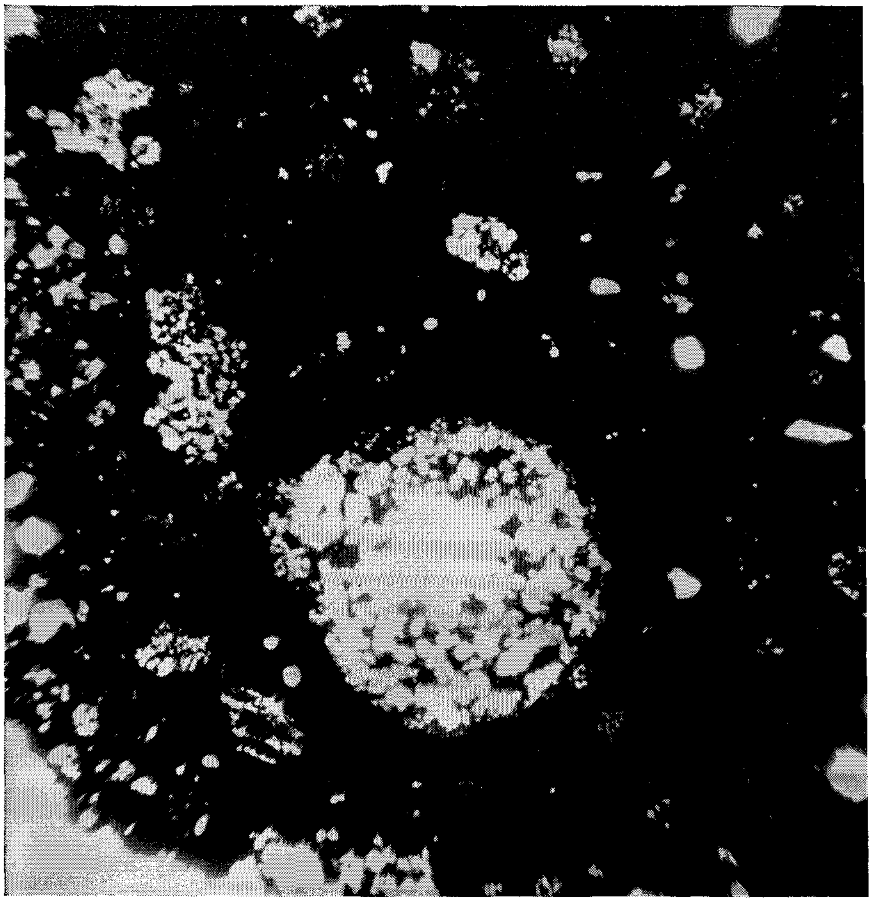
An extremely significant feature is manifest especially in the Beddgelert stone, which fell in North Wales in 1949, through the roof of a hotel. This is a very hard chondrite which easily scratches glass. Paneth tested both its silicate and metallic phases for helium and radioactive content. The silicate phase seemed to have solidified more than 1,000 million years ago, whereas the metallic phase was solidified about 200 million years ago; about one fifth the time, or 800 million years later. Several lines of evidence suggest that the metallic phase did form considerably later than the silicates in this and

SECONDARY METEORITES

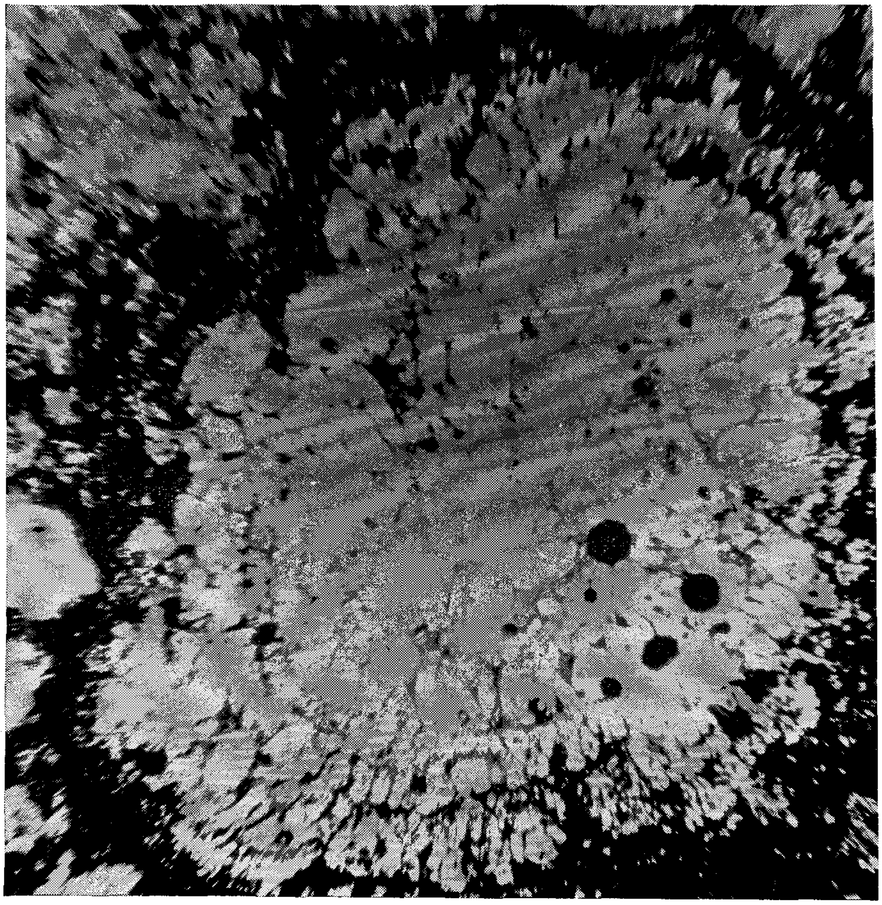
Murray, Calloway County, Kentucky, weighing 12½ kg. was seen to fall September 20, 1950. This is a type II carbonaceous chondrite showing chondrules and irregular aggregates of olivine grains in an opaque ground mass of serpentine and carbonaceous matter. Type II is intermediate in carbon, water and sulfur content to types I and III. Their densities range from 2.5 to 2.9. They are weakly or non-magnetic. For certain trace elements such as Bi, Pb, Tl, Hg the content is an order of magnitude higher than in normal chondrites. The carbonaceous chondrites also show an abnormally high content of inert gases, especially xenon. The explanation of this type of abnormality will never be evident until better analyses of the primaries are available. It is also possible that the inert gas content could have been altered during the four million years cosmic basking time that this stone endured.

The discovery of certain alkanes, hydrocarbons and heterocyclic bases in carbonaceous chondrites by Dr. Warren Meinschein links the hydrocarbon content with life remnant substances in early sediments. Many scientists believe that this links this meteorite with life.

Vigarano, Ferrara, Italy, fell 1910, January 22, 9:30 P.M. In this section one sees a large olivine chondrule. Inside this chondrule we see spherules of nickel-iron about 0.1 mm diameter in the original unmagnified section. This might be expected from the condensation of vapors in a liquid field. (Anders, June 1963) This is a type III carbonaceous chondrite. One stone 11½ kg. was seen to fall. A month later a 4½ kg. stone was found.



SECTIONS COURTESY OF THE AMERICAN MUSEUM OF NATURAL HISTORY PHOTOGRAPHED BY AUT



other meteorites as well. We suggest that the metallic phase could have been injected by a meteoric blast.

The chemical composition of the chondrules varies as one analyzes the several classes, but the morphology, the similarity of the magnitudes of the fragments, seems to stare significantly through the microscope tube like a wife's meaningful look. As one looks from chondrules to achondrules, the shapes change, or brecciated, as the mineralogical expression goes. In the achondrites there are no spheres, but just a powdery mass of irregular crystal fragments imbedded in the amorphous background. The same dimensions prevail, however. The largest angular fragments are generally about one millimeter in cross-section. There is a feeling that this size has something to do with strength of materials, moments of inertia, resonance frequency or perhaps surface tension of the molten glass with respect to maximum shock effect. Experiments by Milton and DiCarli suggest that the fractured and refractured appearence of the achondrites may be due to reflected shock waves.

Nickel-iron has been mentioned as the most prevalent metal, but when it is absent, magnetite appears in its stead. The incidence of magnetite seems to be dependent on the availability of oxygen and water or hydrates to quench the white-hot steel. Other evidence suggests that the achondrites were shielded from the more direct action of the shock waves and high-pressure vapor by interposing layers of rock which may have themselves produced chondrite. More significant is the trevanite, which is a magnetic nickel-iron oxide(Ni,Fe04). Midst the steel, in some specimens, we see similarly shredded triolite. Triolite is a relatively rare mineral on Earth, but it is a rather plentiful constituent of octahedrites, occurring in large nodules. Although the crystalline structure of the metallic fragments can be detected by X ray, they appear to be amorphous even to the microscope.

The grossly crystalline structure of the primaries is due to long, slow cooling under high pressures. This difference of gross metallic crystallization is a boundary marker between the primaries and the secondaries.

On the lower fringe of the list are the achondrites. These meteorites resemble terrestrial rocks more closely and admit less exposure to high pressure meteoric vapor, but close scrutiny seems to reveal some nickel-iron or magnetite in nearly all of them. This nickel-iron taint is an almost universal characteristic of stony meteorites which is almost completely absent in terrestrial rocks.

Judging from the high-pressure meteoric iron, whether quenched as magnetite or simply frozen, it seems that all collected stony and stony-iron meteorites to date appear to be secondaries.

Another dividing characteristic which we impose on the category of secondary meteorites is their apparent cosmic exposure ages. When a meteoroid drifts around its orbit in space, it is exposed to cosmic rays. These high-speed cosmic particles cause changes in the atoms contained in the meteorites. In the case of the irons they chip He^3 from the nucleus of the iron. This, therefore, is referred to as cosmic spallation. By measuring the content of He^3 in an iron meteorite, one can determine the break-up age of the specimen. There is also the lead isotope method, the rubidium-strontium method, the rheniumosmium method, the potassium-argon method, the uranium-helium method, and others. Interestingly enough, where several methods are applicable to the same meteorite, they usually concur on the same order of magnitude. This work of determining ages is tedious and expensive. So far it has been confined almost entirely to chondrites.

We have previously reprinted a well-known bar graph indicating the time scale of the development of the solar system as indicated by meteorites. This graphically illustrates the gap of $51X10^7$ years between the break-up times of most of the iron meteorites and the stony meteorites. There is considerable overlap, however. The youngest iron found to date is Braunau: 8 million years old. This bar graph is now modified with a superimposed Gaussian curve which more probably indicates the nature of the distribution of the stony meteorite ages. This is sketchily extended by Ander's recent work—September 1962—revealing the two youngest meteorites so far: Farmington, 100,000 years cosmic basking time; and: Cold Bokkeveld, 82,000 years. It is hoped that the finding of these younger stones will stimulate the search for older ones; say, one billion years or so. Those would probably represent the silicate crust of the primary asteroid planet.

We have been recommending eighteen targets as sources for the meteorites. Without the multiple sources one would have difficulty explaining the occurrence of fossils in one chondrite and xenon 129 in another.

Xenon 129 is a rare isotope which is the descendant of iodine 129, a radioactive form of iodine created with the rest of the elements that formed the solar nebula and became extinct not many millions of years later. The presence of the element in a stone would indicate that it was formed during the infancy of the solar system and was preserved in the cold vaccuum of space free from the excoriations of weathering and decay.

Bethany, Great Namaqualand, South-west Africa, is a fine grained octahedrite that was known before 1836. Fifty-one large masses totaling over fifteen tons were found; the largest, over 1,430 pounds. This illustrates the Widmanstatten pattern which depends upon the cooling time and pressure to which the fragment has been subjected. Among the masses identified with this swarm or shower is one found on Amalia farm. The cosmic basking time of the other fragments are concordant, but this one differs markedly. Either the swarm captured and held this one in their gravitational field or this is a rare instance of two falls in the same area.

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SECONDARY METEORITES

Such a body could be found in the solar system as a satellite of Jupiter. Xenon 129 has been found in a chondrule of Bruderheim which fell in Canada in 1960. Renolds has demonstrated Xe^{129} in the Richardton chondrite.

Hydrocarbon compounds require a warm planet with an active atmosphere and moisture. This would be inimical to the preservation of Xe^{129}. Therefore, with these two extremes there at least must be two separate orbs on which these two meteorites formed, and, of course, a way for them to escape.

A similar problem was revealed by Geis and Hess when they demonstrated that the ratio of K^{40} to Ar^{40} in certain meteorites indicated a storage at 190°K.

Another suggestion of the origin of certain meteorites is evident in their gross morphology. Anders has compared and commented on the similarity of the fracture patterns in Goalpara and the sheared coconino sandstone from the meteorite crater in Arizona. This would suggest similar treatment of the two stones.

Finally, it is suggested that the observed ratio of meteoric in-fall is the result of intra-planetary meteorite commerce, trading large single irons for multiple small stones at any one of the nineteen obvious trading posts.

Critical Discussion

Surely no one has been so misled as to think that this is the only theory regarding the origin of meteorites. There are two other predominant ideas:

1. That all meteorites originate from the breakup of a planet in the asteroid belt.

2. That the meteorites originally accreted from the cold gaseous building blocks of the universe in space, and by frequently orbiting around the Sun, became distilled and baked into existing meteoric forms.

All of the theories relate the various meteoric forms by oxygen-reduction, hydration-dehydration principles. The concentric layers of the asteroid planet would be related from the inside out by oxidation, hydration and flotation. The cold accretion theory would relate the various forms by reduction, dehydration, and volatilization.

This theory presented here suggests that the meteorites were first related by oxidation, hydration, and flotation in existing planets and satellites, as well as the "Asteroid Planet," which has almost disappeared. Secondly, they were derived from these target planets and satellites by a process that would subject them to reduction, dehydration, and volatilization. One of the virtues of this theory is that it is more complicated. You know that nothing is as simple as it first seems!

One is reminded that a good deal of circular thinking occurs here. We study the meteorites and line them up in a fashion that we believe reveals the internal structure of a planet and then we proceed to explain the meteorites on the basis of what we have thus postulated. There is some corroborative evidence, however. Deep mines and drill holes, primitive earth formations, volcanic material, seismic information, and all, tend to strengthen our theories. The project Moho, where they will drill through the ocean bed deep into the earth, will also shed more light on the problem soon.

Biogenic carbohydrates cannot be accreted in cold space. It is not that this is the only argument that weakens that thought. For a generation cold accretion proponents have choked over pallasites. These are grossly crystalline irons that have brecciated two centimeter crystal fragments of olivine spiced through their substance. The melting points of these two substances are separated by three hundred degrees F., olivine being 1800°, and meteoric iron, 1500°. Trying to convince scientists that these two sub-

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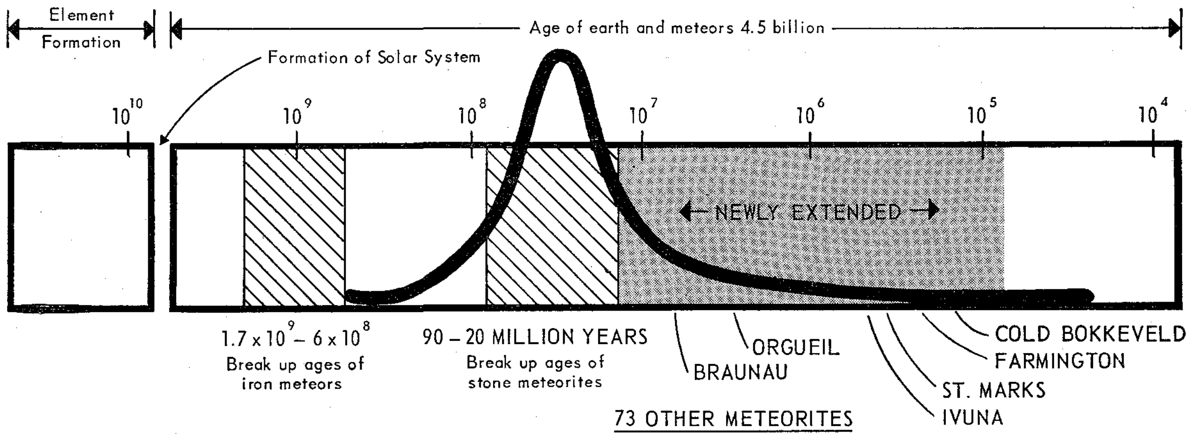
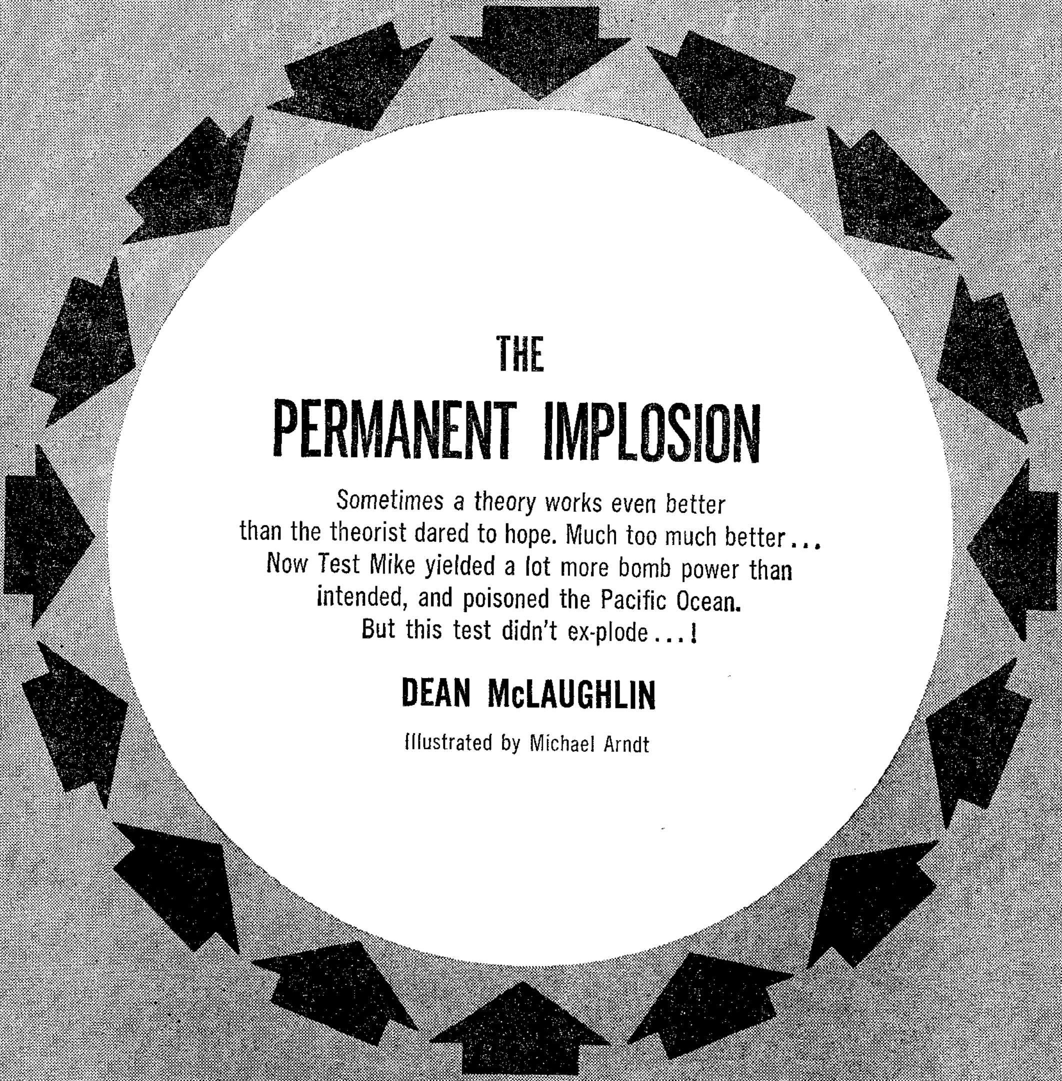


TIME SCALE OF THE DEVELOPMENT
OF THE SOLAR SYSTEM, AS INDICATED BY METEORITES



THE

PERMANENT IMPLOSION

Sometimes a theory works even better than the theorist dared to hope. Much too much better . . . Now Test Mike yielded a lot more bomb power than intended, and poisoned the Pacific Ocean. But this test didn't ex-plode . . . !

DEAN McLAUGHLIN

Illustrated by Michael Arndt

The fire was out. It had taken two tries, but now it was out and the well was capped. Workmen were beginning to cut up the shoved-aside wreck of the heat-buckled drill rig. A bulldozer bumbled ponderously around, scraping up random debris.

Mick Candido sat on the truck's running board and worked on his pipe. It was always going out, or the tobacco was getting too tightly packed in the bowl to burn right—or something. His body was sticky with sweat under his clothes. He was tired. It had been a rough day.

Money in the bank, though.

A thump and then a scuffing rustle back in the truck's body told him Ken Storch had heaved another roll of hose aboard. One more to go, he thought—and then the pump. Then they'd be loaded, ready to go. The other trucks had already gone.

He gave up on his pipe. He leaned back and watched the helicopter coming over the wind-scalloped, treeless hills. It was down low to the horizon, no larger than a gnat. The sky was clean—the rich blue of the high plains, and a few white featherwisps of cirrus. He pulled out his tobacco pouch, zipped his pipe inside, and returned it to his pocket.

Another thump hit the truck bed. Ken Storch came around the side. His shirt was dark with sweat. He brushed hair back from his forehead with a grimy hand. "All done but the pump, Mr. Candido."

Candido stood up. He was a big man—not so much in height as in muscular mass: broad shoulders, thick body, and powerful legs and arms. He'd been first-string center on the football team at East Texas College for three years, and he hadn't done bad on the wrestling squad, either.

"Right," he said, and they walked down the hill to the mud-plastered trench. It had been full a few hours ago; now a few puddles glistened slickly in the deeper hollows. They'd had to use almost all of it.

Together, they lifted the pump and carried it back up the slope. It weighed one hundred and sixty pounds; not much for a pump, but it could throw four hoses of water at once—hard. You could depend on it to keep on throwing water, too, which was a necessary thing when you were in your klansman's suit—asbestos hood and coverall

—trying to get the dynamite in close enough to the torch that the blast would snuff it. Times like those, Niagara itself couldn't be too much water; it steamed off your back like smoke.

They raised the pump over the tailgate and slid it into the truck until it pushed up against the wet rolls of hose. Hardly out of breath at all, Candido folded the tailgate up and hooked it shut, then rattled it to make sure it was fast.

"Back to the motel?" Storch asked.

"Not yet," Candido said. He was watching the helicopter again. It was a lot closer now. He could see the blurry sweep of its rotors, and he was thinking of the long, bumpy ride back to Sand Springs—three and a half hours on dirt tracks you could call roads only in the sense that jeeps and trucks with lug tires could struggle over them. If the copter was going to land here—and it looked that way—and if it was going back almost right away, maybe he could cadge a ride aboard. If they had space for another passenger.

He thought about his room in the motel. It was air-conditioned. He needed a shower and fresh clothes. He needed another treatment of salve on the burns he'd got in spite of his klansman's suit. And maybe a big steak dinner, and then a good long sleep.

He always felt that way when a job was done.

The helicopter settled on its wheels with a blast of wind. Dust and sand flew. Before the rotors had stopped turning, the door opened and a man stepped down. He wore a business suit, but the helicopter was an Army machine: painted ugly green, and a white serial number stenciled on its flank like the brand on a cow.

The man came toward the truck. He walked carefully, watching the ground where he set his feet. He wore ordinary street shoes with low sides. The sand gave way under his feet.

"Hello," he said. "I'm looking for Michael Candido. You work for him?" He nodded to the truck. *Wellfire Blasting, Inc.* it said in flame-limned letters on the door. *Fort Worth, Texas.*

"I *am* him," Mick Candido said.

"Good," the man said. "We need you. I just came from Denver."

He said it as if Denver meant something.

"I'm from Fort Worth, myself," Candido said. "What did you say your name was?"

"Hugh Trask," the man said hurriedly, as if the business of names was a nuisance to be got out of the way as fast as possible. "Civil Defense, Denver District." He was somewhere in his forties. His jowls had a meaty, thick look.

"Pleased to meet," Candido said. He stuck out his hand. It was filthy. "Now, business?"

"You mean you haven't heard? You don't know about the whirlwind?"

"Friend," Candido said, "when I'm out on a job, I don't hear nothing but job and I don't think anything but job."

"Well, we need a man with your experience," Trask said. He nodded back toward the helicopter. "Will you take the job?"

Candido frowned. "Since when did they have a field near Denver?"

"Field?" Trask's face was blank.

"Oil field," Candido said. "Wells."

"Oh!" Trask understood now. "But it's not an oil field. It's not even a fire. What we want you for . . . well, it's complicated." He waved a hand to the helicopter. "I'll tell you about it on the way."

Candido got out his pipe. He made sure he could draw through it, then packed tobacco in the bowl. He took his time. "I'll accept a ride back to town," he said, making it sound like a major concession. "You've got me curious, all right. I'll listen." He turned to Ken Storch. "You take the truck in," he said.

"Then you'll take the job?" Hugh Trask asked anxiously.

"I said I'll listen," Candido said. He got his pipe lighted and broke the match and dropped the pieces in the pocket of his denim shirt. "If I like how it sounds, we'll talk business." He started upslope toward the helicopter. Trask tagged alongside. "You're authorized to sign a contract?" he asked Trask.

Trask was out of breath, though the climb wasn't steep.

Behind them, Storch got the truck started. There was a grind of gears.

"I don't know," Trask said. "I think so. We have a disaster fund, and this . . . well, this is that, for sure. But surely business arrangements can wait. This . . . this is important."

The door in the helicopter's side was open. Candido grabbed the hand-hold inside, stuck his foot in the toe-step, climbed inside. Out of the bright sunlight, it was like suddenly going blind. He groped and found a seat and sat down. "It's always a good time to talk business," he said. The seat was much too small for him, but he was accustomed to that. Most seats were. "Business happens to be my game."

"Lift up, Mr. Trask?" Someone asked from up forward.

"Yes. Take off," Trask said. He was buckling into the seat across the narrow aisle. Candido found his own seat belt. Its straps were just barely long enough to reach around him. The helicopter's idling engine roared up to power. A shutterlike shadow flicked across the forward window, then came again—then again and again. The helicopter vibrated, buzzed, surged, and the ground dropped away. After a moment, Candido could look out the window beside him and see, far below, the tiny fittings of the wellhead and the wrecked drill rig and the blackened earth in a circle around it like a blot of ink, and the men and the bulldozer swarming over the scene, like wonderfully perfect toys.

The low, rippling hills ridged the land like a lethargic, heaving sea. Candido watched them drift past underneath and listened to the engine's noise, and heard Trask tell of the thing that had happened near Denver.

No one would ever know exactly what had happened. The only men who might have known had vanished—devoured by the thing they'd created. There'd been a research laboratory on the plain northeast of Boulder; Civil Defense hadn't yet found out what it had been doing. Anyway, it was gone now, and where it had been the center of a vast, powerful whirlwind wheeled and roared. Everything for miles around had been swept up by it—smashed, shredded, uprooted, and carried away.

"This is the significant point," Trask said. "Something in the center of that whirlwind . . . something is drawing air toward it, very forcefully. That's what's causing the whirlwind."

"Hm-m-m," Candido said. "Where's all this air going?"

"Huh?" Trask's brows squeezed together like rope twisted tight, beginning to bunch. "Why, I hadn't thought about that. However, I suppose our physicists know, and it makes no difference. The thing we want you for—you're experienced in the handling of explosives under . . . well, unusual conditions. Our physicists believe that the shock of an explosion close to the center of the whirlwind will destroy the . . . uh, the condition that is causing it."

Candido thought a minute. "How fast did you say the wind's going?"

Below them, the land opened into a deep, gully-carved valley. The kinked and twisting channel was white-crusted—dry as a skillet. Eye-glazing light shimmered on arid promontories. Then the land lifted again and the valley fell behind. Over the rolling plain, dust devils twisted.

"Understand," Trask said. "We haven't been able to get close to the center to measure the wind velocities there. And there's too much dust for us to estimate by observing things caught in it. But about five hundred yards out, it seems to be blowing steadily at a hundred and forty miles an hour."

Candido grunted as if he'd taken a fist in the gut. "Not what I call a breeze," he said. "Take something big to put a dent in it. What about these physicists of yours? How much of a blast do they figure it needs?"

"I don't handle technical details," Trask said. "I'm an administrator. I have no idea. I haven't discussed it with them."

"Maybe it'll make a difference whether I take the job or don't," Candido said. "Usually my price goes up five thousand for every hundredweight of Hercules over three hundred pounds. If it's over a ton, I don't even talk to you. I wave good-by. That's how it's sounding right now."

Far ahead now, they could see the town, Sand Springs. It was a patch of green on the scrub-dotted land, nestled among the naked hills, tiny with distance—too small, it seemed, for a town; but over it stood the toy-size water tower on spread legs. Ten-fifteen miles.

"They tell me it might not take a particularly large blast," Trask said. "They believe the thing that's causing it involves a delicate balance of forces, and only a small additional force would upset it."

"They think that, huh?" Candido said. He thought for a while, as the town came gradually nearer and nearer, hillcrest after hillcrest. He'd just finished a job, and it was money in the bank, and no new jobs were shaping up. This whirlwind wasn't his usual line of work, exactly, but it did have ginger in it—something different. Something new, a challenge, like the time he was a boy and a kid three years older had scratched a line in the dirt and said for him to cross it. He'd looked the kid up and down, taken his measure, and stepped across the line and smashed him flat. He began thinking about how to get to the center of that roaring wind.

"Naturally, you'll be given all the assistance we can," Trask said. He was talking quickly, anxious, trying to persuade him. "And all the equipment you need. This . . . this is a disaster. It's got to be stopped. Soon."

"Well," Candido said, and paused to read Trask's face. The man was frantic—maybe a little desperate, even—but that didn't help much when you were haggling with the government. Uncle Sam was a tough old skinflint when it came to bargaining, and even if you got it down in black and white on good crisp parchment, you still couldn't be sure the deal would stick. Just the same . . .

"I don't say I'll take the job," Candido said, "but I've got to admit I'm interested. Anyway, I'll go as far as Denver and look it over. Good enough?"

Trask called forward for the helicopter to change course and fly to Denver. Candido countermanded the instruction and obliged them to land at the edge of the town. It was a short walk to the motel. There he showered, shaved, and got a change of clothes. He packed, left word for his crew to bring the trucks down to Denver, caught a sandwich and coffee at the nearest cafe, and walked back to the helicopter.

The pilot already had the engine going when he climbed aboard. As soon as he was safety-belted in a seat the rotors began to turn and they were air-borne. It was late afternoon. It was night before they arrived over Denver.

The helicopter had curved far east over the plains and approached the city on a westward course. The wind gusted roughly, jolting the craft. Thick cloud clotted the sky. The city's light filled the overcast with a glow like embering fire.

Trask had telephoned of their coming before they left Sand Springs, and in spite of the lateness of the hour there were men waiting in a conference room in the Centennial Hotel. The streets were wet with rain.

Candido glanced at the blank blackboard and the board next to it on which a topograhic quadrangle map had been tacked. One of the men had a piece of chalk in his hand. He was almost bald and he wore rimless glasses and he was thin. His shirt was open at the throat. His tweed had leather patches at the elbows. A waiter arrived with a large pot of coffee and a half dozen cups. Candido remembered how long it had been since he'd been near a bed. He got out his pipe, stuffed the bowl, dabbed a match over it until the tobacco caught.

The man with the piece of chalk was Willard L'Heuroux, and he was a physicist from the university at Boulder. He rubbed the end of the chalk with his thumb. The palp of his thumb was white with the dust. He had only a few details to add to the information Trask had given already, but Candido listened carefully. Details could be important—even small ones.

The center of the whirlwind was over a rise of ground named Gunbarrel Hill. It showed clearly on the quadrangle map, even to someone who didn't know how to read contour lines. Candido knew how. He studied the few roads that gridded the area and thought about the wind that was strong even here, twenty or thirty miles away. He didn't like it.

L'Heuroux had some high altitude photographs of the whirlwind. It was a vast, round, doughnut-like cloud, like a hurricane but with almost no eye. Storm clouds surrounded the toroid, and the photoplane's pilot had reported a powerful downdraft even at sixty thousand feet. Air was flowing toward the whirlwind's center from all directions—from above as well as from all points of the compass.

That was all the fact they had. All the rest was theory, as unprovable as the noise an unseen tree makes in falling. But one of the research problems being worked in the lab, which the whirlwind had smashed, had been a direct investigation of an aspect of Mach's principle—that in a universe with no material objects, all points are identical since there can be no reference points on which to base a system of co-ordinates. No one really questioned this concept any more—at least, no one of the proper sophistication.

"Pardon me," Candido said. "I always thought we've got a universe with a few material objects lying around."

"Quite true," L'Heuroux said. "However, if we should choose to ignore that point—and mathematically I assure you it's very easy to do . . ."

Candido growled skeptically and rubbed his brows with the heels of his thumbs. "All right. Go on."

Well now, if all locations in the universe were identical, it naturally followed that transfer of objects from one place to another should be ridiculously simple, since obviously they were in both positions—among others—all the time. Of course, the real universe didn't precisely conform to the idealized scheme being utilized; some compensation had to be made. This had been one of the problems the laboratory was investigating. A secondary, more difficult problem had been to control selection of the non-different points which were being made congruent.

Maybe it was because he hadn't had a good night's sleep the last few days, but Candido couldn't grasp the concept. Like trying to gnaw fog, he thought. He added just enough cream to his coffee to lighten its blackness. He drank half the cup in one draught.

Maybe the coffee helped. At least he got the idea of the next part—that at the center of the whirlwind was a locus, a volume of space, which was simultaneously in two places. One was a few yards above the surface of Gunbarrel Hill. The other was . . . well, somewhere else. And since something more than ninety-nine per cent of the universe is interstellar space, what could be more logical but that the somewhere else should be such a region? And it was vacuum there—a vacuum more empty than any that could be made in any laboratory in the world. Nothing could be done to prevent the air contained within the congruent volume from escaping into the emptiness around it.

Candido's pipe had gone out some time ago. He opened his jackknife and pried the mess out of the bowl and dumped it in an ashtray. He started over.

"You figure a hard blast of Hercules will knock this thing off?"

"That is our belief," L'Heuroux said. "The whirlwind has destroyed all the equipment that created it. Therefore, the condition of congruency must be one that is self-maintaining. This would mean, we think, a moderately delicate balance of forces which an abrupt shock—such as a disturbance in the patterns of movement of the air molecules entering the sphere—would disrupt. At least, that is our hope."

"And I'm the guy to set the charge," Candido said. It was like someone had pulled the plug, he thought, and air was draining out of the world like water from a bathtub. If it was in the southern hemisphere, he thought, the whirlwind would be wheeling in the other direction—clockwise instead of counterclockwise. He wondered how long before there wasn't any air left. He began to know how goldfish feel when their bowl is smashed.

"All right," he said. "You've got your man. You supply the equipment—I'm set up for fires, not wind—not a wind like this, anyway—and I'll do the job. Two hundred thousand."

Trask's face was like a papier-mâché mask, his eyes staring through the holes. "That's rather high," he said. His voice was a little unsteady.

"It's dangerous work," Candido said.

"But our budget isn't a tenth of that."

"Call Uncle," Candido said. "Two hundred thousand. I figure that's pretty cheap for all the air you can breathe."

The corners of Trask's mouth twitched as if he felt pain. He stood up. "If you'll excuse me," he said, and left the room.

Candido waited. Nobody spoke. Trask was gone ten minutes. He came back and stood in the doorway. "I'm instructed to offer fifty thousand," he said. "It will mean asking Congress for a special appropriation, but we can offer that much."

"As a taxpayer, I think that's a good offer," Candido said. "As a businessman, I say it's no good. Two hundred thousand."

Trask met his eyes for a moment, then turned and went out again.

Candido turned his attention to L'Heuroux. "How long's it been blowing?"

"Three days," L'Heuroux said. "Two and a half. It began in the afternoon, day before yesterday."

"How long before we don't have any air left?" Trask asked.

To judge by the look on the physicist's face, it was something he hadn't thought of. "Why, I really don't know," L'Heuroux said. "I'd have to compute. I don't think we have the data. I assume what you mean is, how long before the air pressure drops below the level at which it can support life."

"That's close enough," Candido said.

"Otherwise," L'Heuroux said, as if Candido hadn't spoken, "I would have to say we'll never have lost all our atmosphere. As the air pressure drops, there would be less pressure forcing air into the congruency. Therefore, since the pressure drop would be progressive, an infinite length of time would have to pass before all our atmosphere was gone."

"If I can't breathe, I don't call it air," Candido said. "How long do you figure?"

Trask came back then. He sat down. "All right," he said. "Two hundred thousand."

"In writing," Candido said.

"All right. In writing. Tomorrow morning."

"Good enough," Candido said, satisfied. "That'll just about pay my income tax."

The wind blew gale force at the edge of Boulder. Houses had slashed roofs and trees lay uprooted. The tank's Diesel was a growl above the whirlwind's blast.

They'd spent a day getting ready—moving the tank down from the Army camp near Cheyenne and learning how to drive it and waiting for his crew to make it down from the Gas Hills. They'd come in last night. The tank weighed sixty-four tons and it had a low silhouette. Massive enough, Candido figured, that the wind wouldn't bother it too much. Ken Storch rode in the gunner's seat beside him, and L'Heuroux rode in the turret. Candido hoped the hatch lock would hold. He'd checked it and he thought it would, but if it didn't the wind would suck them out like marrow from a bone. He was mildly curious what was on the other side of that congruency, but not so curious he wanted to go there.

Scraps of debris—some of them not small—skipped along the ground, sailed up into the air. A tree branch went by. A section of billboard touting Coors beer. Another advantage to the tank, it could move across country. It didn't have to keep to the grid pattern of roads. It could keep the wind at its back, if that was the only way it could move.

But here, still close to Boulder, he stayed on the road. It was easier going, and the wind wasn't strong enough to bother him yet, and it was tricky to drive with just the narrow slit of the periscope to see through. You could lose your bearings fast. He gripped the brake levers, now and then tugging a little at one or the other, keeping the machine on an even course down the middle of the road. There wasn't any traffic—just the tank and the empty road. Rain squalls lashed the pavement and passed on. The wind screeched like a mountain lion in rage. Gusts made his ears pop, and he had to swallow to get his hearing right again.

The road turned, then turned again, and then they were grinding up the slope. Wind blasted on the tank's flank like a padded hammer, and the noise of it almost blotted out sound of the laboring Diesel.

"What's air pressure?" Candido asked.

"Twenty and six tenths," L'Heuroux said, behind him.

He felt vibration in his bucket seat. He had to use the brakes a lot to keep the tank from drifting sidewise into the ditch. The tank's treads clawed the pavement. Scrabbled. Down to twenty and a half already, and still more than a mile to go. He could imagine the torn asphalt they were leaving behind them, even though he couldn't turn his periscope enough to see.

Then they were nearing the hillcrest, and here was the turnoff to where the research lab had been. Candido

hauled on the left brake lever and the left tread locked and the tank spun to the left and the wind hit the tank's side as if a shell had burst on the armor. Candido let up on the brake and the tank stopped turning, and he upped the throttle and the Diesel's snarl raised its pitch a few notes and they ground forward into the drive.

The land was ripped bare like bones cleaned by carrion birds. Not even grass grew in the earth. Here and there, a wooden fencepost had held against the blast. That was all. Ahead, a little to the left of the road, the air was in violent turmoil. Debris and dust and cloud streamed inward from all directions. Candido stopped the tank and studied the epicenter, but he was too far away to make out anything clearly. He slacked the brakes and put in the clutch, and the tank lurched forward. "What's the pressure like?" he asked over his shoulder.

"Fifteen and seven tenths," L'Heuroux said. The tank shuddered with the impact of wind. Candido kept his eyes on the center of the converging winds, only now and then glancing at the road. This road didn't have ditches at the verge; he didn't have to worry about getting caught in one of them. He did some mental calculations.

"It should be up around twenty-five," he said.

"Within a point or two of that," L'Heuroux said. "That's normal for this altitude."

Candido stopped the tank. "We don't go any closer," he said. The tank trembled in the wind's fury. The wind was an unending scream.

"Is something wrong?" L'Heuroux asked.

Candido could just barely see what was left of the laboratory building's foundation. He'd have liked to get closer, to study out the kind of ground he'd have to work over when they went in to plant the Hercules. Not now, though. Not with the pressure down there. His shoulders felt like they were wearing plaster casts. He felt a peculiar singing in his blood.

"Nothing's gone wrong yet," he said. "It would if we kept on going." He got the tank turned around. He gave the Diesel full throttle. It was like trying to probe bottom in quicksand. The tank didn't move. The Diesel didn't have any power. The wind drove against the tank, striking from just off the starboard bow. Its force was stronger than the Diesel.

"We don't go any closer without breathing equipment," Candido said. "And a supercharger on the engine. We're not getting enough air to breathe right, and if I'm any guess it's even thinner the closer you get to . . ." He let a gesture complete the sentence. "If we get much closer, we'd keel over. And we'd have our engine stall."

He got the tank turned to the left, fed power to the Diesel. They lumbered off the road. The ground was uneven. The tank bumped and jolted. The engine still didn't have much power, but they were going crosswind now instead of fighting it. He had to crab into it some, but that was possible. They made headway.

"Why, I hadn't considered that," L'Heuroux said.

"Didn't think you had," Candido said. "You're not in business. Did you get a figure for wind velocity?"

"Not a very dependable one. I think the equipment must be damaged."

"What's the figure you got?" Candido asked.

"Two hundred and ninety miles per hour," L'Heuroux said.

Candido twitched the right hand brake lever, quartering them into the wind a little more steeply. He could feel the treads slip and jerk as they clawed for footing. Ahead, the land sloped gently downward. The wind sang its fury. Candido thought of all the air vanishing into that bottomless vacuum—air no man would ever breathe again.

The breathing equipment was no problem. Face masks and air tanks and a compressor were part of Candido's stock of equipment. A supercharger for the Diesel wasn't so easy.

Diesels weren't built for high-altitude work. Superchargers didn't exist. Candido catnapped most of the afternoon in his Boulder motel room while Trask and his subordinates telephoned everywhere, trying to locate something that would fill the need. They had trouble, Trask said, because a lot of wires were blown down.

Finally—it was almost five—they found one in Dayton. It was designed for a gasoline engine, but it could operate—not efficiently, but it could operate—at the tank Diesel's RMP. It was loaded on a jet transport at Wright-Patterson and flown west. Candido spent most of the night watching it being installed. They had to cut away some of the armor to make room for it, and then they had to build a housing for it to protect it from the wind and flying objects. It screamed like a devil with its tail being stepped on. It was a jerry-rigged, makeshift assembly. Candido made sure he could control it. Finally, he was satisfied.

"All right," he said. "Now, will it do the job where we're going?"

The engineer managing the job was a hairy, scrawny man named Henry Janiszewski. "It's working as good as it ever will," he said, wiping his hands on a rag. "If you want more than that, you'll have to ask someone else." He rolled down his sleeves, exposing sergeant's stripes.

It was midmorning now, and nobody had got much sleep. Trask didn't know. L'Heuroux, when they woke him and got him to understand through his drowsiness what the question was, didn't know either.

"We don't go near the whirlwind till we've tested it," Candido said.

"Tested it?" Trask asked. "How?"

"I want to know that engine works and gives power where the barometer says ten inches," Candido said. "If it's going to quit, I want it to quit while we're testing it —not while I'm in it, looking that wind in the eye."

"But where in heaven is there a pressure chamber large enough to take that . . ." L'Heuroux's hand flapped wildly in the direction of the tank. "That monster."

"Not heaven," Candido said. "Here. How should I know? Don't you?"

So another search began. It didn't take as long, this time. Not many pressure chambers of size existed. Someone in Washington dug out a list of them, and there was one big enough in a missile factory in the foothills southwest of Denver, less than fifty miles away.

Candido made the ride down in the cab of the tank's carrier rig. He held his breathing equipment on his lap. Rain fell most of the way—slashing, hurricane rain. They were expected; the guard waved them through the gate without stopping, and pointed them the way to go.

For all its size, the pressure chamber was just barely big enough. The tank fitted inside like a chick in its egg. The pressure chamber and its massive vacuum pumps were part of the missile company's research equipment, and the whole rig-up had cost—Candido didn't catch how many hundred thousands. They were proud how much it had cost. Candido cracked a grin and said it was a lot of cash to spend for nothing. They didn't get the joke. They explained earnestly that a really solid vacuum was a hard thing to get, and to get a good one was worth a lot of money. Candido shrugged and they got to business.

He breathed canned air through his mask and kept the Diesel running while they pumped the chamber down to ten inches. They did it slowly, leaking some air back in to replenish the oxygen the Diesel burned. As the air got thinner, the Diesel's growl changed note. At just under fourteen inches, it began running rough. Candido cut in the supercharger. It smoothed out and stayed smooth the rest of the way down to ten.

He tried throttle settings all the way up the scale. It was hard to tell much—the Diesel kept running all right, but its sound meant nothing in the thin air. He cut the throttle back to idle, made sure the brakes were locked tight, and watched the few inches between the tank's foremost projection and the walls of the chamber while gingerly, fractions at a time, he let in the clutch. The engine stalled.

It took several tries to get the Diesel started again, but finally it turned over. He advanced the throttle a little and tried the clutch again. The brakes still held. He kept on trying. He'd gone most of the way up the throttle settings before the tank even trembled when he let in the clutch. The throttle was almost against the stops when, finally, the tank strained feebly against the brakes—lurched an inch or two forward before Candido hastily opened the clutch.

It wasn't much of a test, but it would have to do. At least he could count on the Diesel to deliver power. Not much, but some. It was slushy, but not so bad he couldn't manage it. He opened the hatch, poked his head out, and signed to the man watching through the window. His ears felt the pressure change as they cracked the valves. Air leaked back into the chamber. A shrill whistle bit his ears. The tank was good enough, now, to risk taking it up to the whirlwind's center. It would still be a risk, but there were always risks. You took a chance every time you crossed the street.

They drove north again through rain and the new-fallen night. He slept in his motel room, woke early, and made sure all was ready for the day's work.

The explosive—a half-ton of high-nitro dynamite—was packed solidly in a lead container. The canister's top was thin, but its sides and bottom were heavy. The charge would be set down directly under the congruency. The blast would be upwards, directly into it. Under the lid, a radiodetonator nested among its wires like a spider in its web. L'Heuroux had taken photographs, and enlargements showed the center of the whirlwind as a large globe suspended ten feet off the ground, in which the turbulent wind swirled in a different pattern than the inward driving winds surrounding it. L'Heuroux had been disappointed that the various color sensitivities of the films and light filters he'd used had shown nothing to suggest the nature of the sphere. Candido couldn't have cared less. He made sure the rigging would hold the canister tightly in spite of the wind's force. He checked the mechanism that would set it on the ground. It would work all right.

Something clanged on the turret as he made the turn into the drive for the approach to the whirlwind's vortex. A tree branch, or something else, caught in the wind. He stopped the tank and locked the brakes. He unwrapped another stick of gum and added it to the wad already in his mouth. He slipped on his breather mask—made sure it fitted tight. Glancing over his shoulder, he saw Ken Storch already wearing his mask. L'Heuroux was fumbling with his.

He waited. Finally, the physicist signed he was ready. Candido turned forward again, slipped the brakes, and boosted the supercharger. The Diesel snarled. With a lurch, the tank advanced. A sudden, brief slash of rain rattled like bullets on the tank's side. Trickles of water dribbled in around the hatchways and around the turret. Cold wet dripped on Candido's neck. He had to yank the left brake handle constantly, to hold the tank on the road. The tank boomed in the blast of the wind.

It got worse the nearer they came. The pinwheeling wind swept more steeply across the road and its force was magnified. The tank skidded and scuttled on the wind-polished earth; there'd been gravel on the road, once, but no more. The parking lot, when they came to it, could be recognized only because it was flat and open while the land around it flowed unevenly. Candido gave it hardly a glance.

Not much was left of the lab's foundations—some masses of concrete still bearing battered remnants of equipment they'd been poured to support, a few fragments of cinder block embedded at the edges of a level concrete floor that lifted perhaps half a foot above ground level, a few steel reinforcing bars jutting out of the floor—twisted, bent, and snapped off: ugly stubs. Something carried in the wind caught momentarily against one of the longer bars. The bar wrenched, gave way, and the object broke and its fragments whipped away so swiftly the eye couldn't follow.

The sphere was ten or eleven feet above the floor, suspended, motionless. The wind drove into it, swirling everything trapped inside it into violent frenzy. Surfaces, tendrils, wisps, and solid things whirled and gyrated crazily, and Candido thought of those part-transparent, part-opaque marbles he'd played with as a boy. The globe was like one of those marbles, wildly spinning, shifting form inside endlessly—or like a picture he'd seen of the planet Jupiter, the planet's globe banded like a zebra and the whole monstrous thing whirling all the way around every nine and a fraction hours. It dizzied the eye.

On the floor, a low, vaguely conical heap of rubbish had collected. Candido stopped the tank—made sure the brakes would hold against the wind. He studied the expanse of floor almost inch by inch, deciding how best to make the approach. It wasn't going to be easy. Those twisted steel rods and concrete piers could do nasty things to the tank's treads. He had to cross at least fifty feet of that mess.

After a while, he moved the tank to a new point of vantage. The floor looked just as bad from this angle. The wind would make trouble, too. It was like a maze game played with steel balls in a strong magnetic field, no mistakes allowed. He took the tank around to the other side of the foundation, pausing for a good look every few yards. There wasn't any good way to get in—just some that weren't as bad as others. The wind forced jets in under the hatches. It was like being stabbed with icicles. The shrill whistlings were like red-hot needles in his ears.

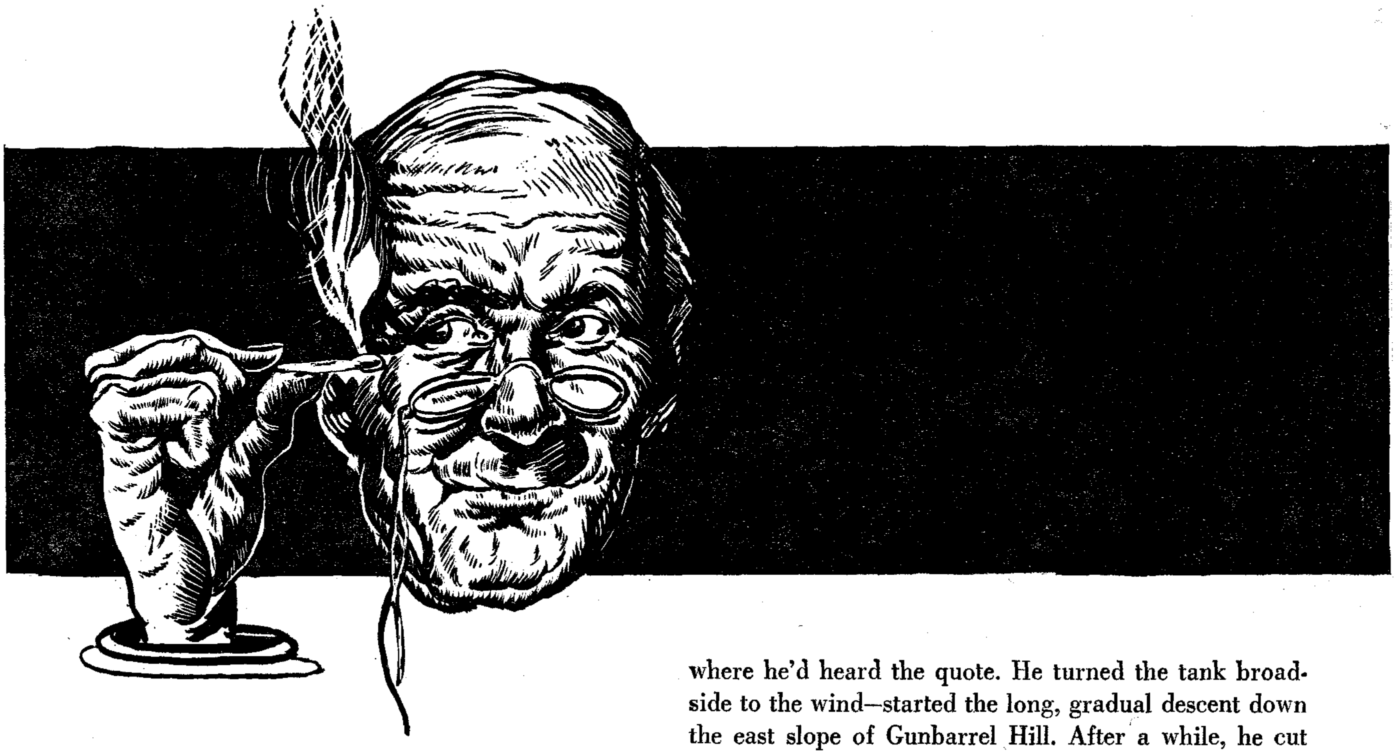
He chose the best way he could find. He hoped the treads would hold up. It was all he could do. Slowly, as if feeling his way, he got the tank up on the platform. Moving only a few feet at a time, he advanced the machine across the concrete floor, twisting, backing and filling, crabbing carefully into the wind, and the wind was like something solid. The wind tried to shoulder the tank—sidewise, cornerwise, or anywise except the way he wanted to go—toward the globe, and the globe hovered closer, ever closer as he picked his way toward it. *Get thee behind me, Satan, and push!* he thought savagely. That was what the wind was doing. He fought it.

The rubbish under the sphere crunched and crushed under the treads like pith balls. Here, miraculously, the wind did not blow. Candido's ears popped. His head rang and he had no strength and his blood pounded strongly. He turned up the supercharger all the way, but still the Diesel's response to the throttle was soft. He knew what the trouble was, all right. He glanced back at L'Heuroux; the physicist held up seven fingers.

He turned back to the periscope, shrugging. Nothing he could do to change it. He maneuvered the tank forward and back until the debris had been flattened. He brought the tank inward once more, maneuvering until the tank's prow was as near to being directly under the sphere's center as his eye could gauge. He opened the clutch—let the engine idle; no need to lock the brakes here. He nodded to Storch.

The younger man had the controls of the explosives handling rig. It was a makeshift: no manufacturer made a rig strong enough to hold against the wind, nor one that could be worked through the constricted ports intended for machine-gun muzzles. It had been a job to build. They'd had to make it flawless, perfect in operation. They'd be no getting out to make repairs while the wind raged, nor here in this semivacuum. It was all a man could do to hold to consciousness against the beating and the vagueness in his skull.

Storch handled the rig like he'd got a Doctorate in rig-handling from MIT. Well, he should, Candido told himself. He'd trained the man himself. Through the periscope, he watched the heavy beams extend, proffering the massive canister forward, then down until the canister's butt touched ground. The beams continued to droop lower and lower, until the long bolts slipped free of the flanges on the canister's sides. Now the beams drew back, slowly,



like arthritic arms that had made an offering to a tyrannical god.

"All right," Storch said. His voice was muffled by his breathing mask.

Candido backed the tank away. He gave Storch time to get the rig retracted. He turned the tank—began to trace the way back through the maze. He couldn't go exactly the same way—some of the way he'd come was, going back, directly into the teeth of the wind. It was like trying to push through a mountain. Even if the Diesel had full power—it didn't, not here, the air pressure so low—in spite of the supercharger it hadn't the power to drive against that slamming wind. He found another way.

A hundred yards off, he turned the tank back to face the sphere. He looked at Storch—nodded. Storch unlocked the radiodetonator box. Candido didn't like using radio to set off a blast—you couldn't trust radio the way you could with wires—but with the wind the way it was, wire just wasn't possible.

The transmitter warmed. Storch looked to Candido. "Any time," Candido said, and turned to the periscope. After a moment, the canister exploded.

The canister's side burst, but the blast's main force was upward. They'd planned on that. It was a sudden belch of light—a jet of incandescence streaking up, stabbing into the sphere like a knife blade. A boll of smoke followed it upward, more slowly. The sphere swallowed them, one and then the other.

Candido watched. The sphere didn't change. The wind blew unslackened. Candido shrugged. If a blast had been going to do it, that blast would have done it. It hadn't. This is the way the world ends, he thought, and wondered where he'd heard the quote. He turned the tank broadside to the wind—started the long, gradual descent down the east slope of Gunbarrel Hill. After a while, he cut off the supercharger and ripped the breather mask from his face.

"Now what?" he asked.

All that came from L'Heuroux was silence. The wind roared and keened.

It was raining in Boulder again. The storm drains hadn't been built for such downpours. Streets in the lower sections were flooded. The creek was over its banks, and up in the canyon a lot of private bridges were gone. A house up there had been smashed by floodwaters, and three people were missing. The State Police had a six-year-old boy who'd been found, crying, climbing the canyon wall in the rain. No one knew where he came from. They couldn't get him to say much, and they couldn't make much sense out of what he did say.

"The more I think about it," Candido said, "the more I start wondering what made you think a blast would do it. What's different about a blast from the way the wind's tearing in there?"

Outside, through the window, he could see the trees writhe and sway in the rain like a modern dance group communicating agony. L'Heuroux cleaned his glasses with a rumpled handkerchief, not watching his hands.

"But remember," the physicist said, "we are dealing with a condition that is self-reinforcing. The wind that is entering the congruency is obviously part of the system. It seemed probable, therefore, that by disrupting the pattern of the winds, we could hope to destroy the condition."

"Well, it didn't work," Candido said.

L'Heuroux looked unhappy. "There was only one way we could find out."

At the end of the table, Trask harumphed. "I don't think that is advancing matters, gentlemen," he said. "I asked you here to discuss what matters we will take now. All of us were disappointed when our attempt with explosives failed. We don't need to dwell on this aspect. I presume, Dr. L'Heuroux, you have new measures to propose."

"Of course," L'Heuroux said. Candido smiled grimly. If you could look inside the man's head, you'd probably see the wheels spinning like a one-arm bandit's. Thirty seconds, mister, or back you go to chasing neutrinos, or whatever it is physicists chase these days.

"Our first attempt," L'Heuroux said, "was to disrupt the condition which maintains the congruency by creating a violent disturbance in the material passing through into the congruency." He sounded like he was lecturing in a classroom—only natural, Candido thought, this being a classroom generously loaned by the university. "It was a logical thing to try first; however, it did not work. I think next we should try . . ." He paused, as if for dramatic effect.

"Yeah?" Candido asked.

"Next," L'Heuroux said, just as if Candido hadn't prompted him—except he bore down more heavily on the word than the word warranted—"we should test the condition's sensitivity to intense electromagnetic radiation. We have a laser which can supply the necessary output. And we have a million gauss magnet. We should try that, also."

"Any special reason you think these'll do it?" Candido asked.

"Certainly," L'Heuroux said, as if a question like that could come only from a mentally deficient five-year-old. "We don't know enough about the congruency condition to be sure what type of external forces or fields it may be sensitive to. Therefore, what we must do is to investigate the condition's reaction to all the influences we can bring to bear."

"Translated into English," Candido said, "you're saying try anything, and if it doesn't work try something else." He tried to remember how many things Edison tried before he found something to make an electric light with. Two thousand? Four thousand? Fifteen? "All right, you've got a couple of things you want to try. If they don't do the job, what's next on your list?"

"Have you an alternative to suggest?" Trask asked.

"Me? I'm not educated the way this guy is," Candido said. "All I've got is a bachelor's in business administration. I don't know about this thing we're working on—I don't think he does, either, but I admit it. All I am, is an errand boy. Tell me the job and I'll do it, but now and then I like getting results from my work."

"I think," Trask said, "we'll try the laser and the magnet. Do you agree?"

Candido shrugged. "It beats thumb twiddling."

"We have to try everything possible," L'Heuroux said.

Candido wondered how you went about learning to breathe vacuum. It might come to that.

The wind still slammed across Gunbarrel Hill, and its cry was the cry of a slavering beast. The congruency's globe hovered like a ceaselessly spinning, pupilless eyeball over the foundations of the laboratory it had destroyed.

If the laser made a sound, it wasn't sound that could be heard above the sheeting of the wind. The thing was mounted in the turret, to beam its pulses of light through the aperture left when the cannon was removed. All through the drive from Boulder, L'Heuroux had been pouring liquid nitrogen from a DeWar flask into the laser's reservoir. It made the interior of the tank very cold. The laser looked like a large, old-fashioned slide projector—an unlovely, functional piece of hardware. L'Heuroux fumbled with it. A blast of wind shook the tank. Something vibrated. A flash of white light filled the tank's interior. L'Heuroux muttered something in annoyed tones. He poured more nitrogen into the reservoir.

There were several more of the white flashes. Then the laser was working. L'Heuroux uttered a satisfied sound. Through the periscope, Candido saw momentary flickerings of red in the streaked, swirling dust clouds. They seemed to be on target, but it was hard to be sure. The tank was a hundred yards from the congruency, halted, with brakes on, tail to the wind and turret turned to aim the laser into the sphere. If the laser was on target, it wasn't doing any good. The sphere didn't change. The wind kept on blowing.

"Want to move up closer?" Candido asked. It was hard to talk clearly through his breather mask. The laser began flashing white again.

"It's heated up," L'Heuroux said. His voice was muffled. He poured another jolt of nitrogen into the reservoir.

"We'll move closer," Candido said. It was possible—all that dust and cloud in the air—the laser's beams weren't getting through. He slipped the brakes, turned the tank toward the sphere, pushed up the throttle. He closed the distance to fifty yards, turned the tank butt to the wind. Ken Storch helped the physicist aim the turret again. The turret handled badly, pounded by the wind.

The lasar flashed white only once this time, and then again Candido saw the flick of red in the airborne dust. This time, there wasn't any question about its reaching the sphere. He could see the momentary stab of red in the swirling clouds inside the sphere. After a dozen pulses, the laser started flashing white again.

"Well, now we know two things that don't work," Candido said. He made sure the Diesel was behaving.

Its reply was a snarling roar. He let go the brakes and moved the tank carefully toward the sphere. The wrecked foundation didn't make as much trouble this time. He knew the way, and the tank had bent or snapped off some of the steel rods the last time it was here. He stopped the tank, as before, in the zone of calm over which the sphere hung suspended like shelter.

"All yours, Ken."

They'd rebuilt the handling rig for its new job. This time, instead of setting a massive canister down, it was to remove a small electromagnet from its supercooling bath and raise it close to the sphere. And this time—because it was a magnet—they couldn't use steel.

Storch manipulated the rig. The lid on the cold bath clattered aside and the magnet rose on the end of a double-jackknifed boom. The boom unfolded—extended to its full length like a scorpion's tail, stinger tipped. Then the boom lifted—floated upward as if it weighed less than nothing. It stopped with the stinger only inches from the whirling tumult inside the sphere. Wisps of frosty air trickled upward like smoke from the magnet into the sphere.

"Any time you want," Candido said over his shoulder. "It's ready."

"I can see for myself," L'Heuroux said, peering through his view slit. There was the sound of him fiddling with equipment. "Ready?" he asked.

"All your show," Candido said. He watched the end of the boom—they were all watching. L'Heuroux closed the switch.

The boom whipped like a fishing rod struck by a big one. It bent down as if a powerful weight suddenly was hung on its end; Candido hadn't thought the aluminum alloy could bend so far without snapping. Then the current cut off automatically. The boom sprung upward. The tank jolted. The end of the boom—magnet and all—went into the sphere and . . .

JEHOSAPHAT!

The boom recoiled, and the magnet and the end of the boom were gone. None of the part that went into the sphere was left, as if jaws had chopped it off with the casual ease of a cow eating grass. Beside him, Storch uttered a yelp of surprise.

That's the last time I stick my head in *that* lion's mouth. It was a silly time to think of an old gag like that, but Candido thought of it. For maybe thirty seconds he couldn't think of anything else.

"Now we know three things that don't work," he said finally, and he put the tank into gear. "What do we try next?"

He got no answer all through the long descent down the eastern slope of the hill, nor during the long circle back westward, back to Boulder.

Two days later, the tank again snarled its way up the western slope of Gunbarrel Hill. The asphalt was smashed and broken from the previous times the tank had used these roads. Now and then, Candido noticed a chunk of rubble caught in a hollow where the wind couldn't sweep it away. Except for such as those, the roadway was clean.

The original handling rig had been put back on, and the new load weighed approximately one and a quarter tons. At first, Candido had balked at having anything to do with a chunk of condensed hell like this. One of the problems when they were inventing thermonuclear weapons had been that even a sophisticated implosion-type A-bomb like the Alamogordo and Nagasaki blasts couldn't produce a temperature hot enough to make heavy hydrogen touch off in a fusion chain-reaction; so the ingenious and dedicated young men who are doing so much in this day and age to insure that men will all live as brothers—if they live at all—produced a special design of plutonium bomb that exploded, not as a simple, symmetrical fireball, but as a jet of plasma. Thus, instead of dissipating its thermal energy in an expanding sphere which, within two or three seconds, has become more than half a mile across—so diffuse it can no longer maintain its chain reaction—this detonator type of bomb concentrates its energy in the jet, exactly like a shaped charge of a more conventional explosive. The temperature thus obtained is on the order of ninety million degrees Centigrade—considerably hotter than the core of our sun—and quite sufficient to ignite an even more hellish chain-reaction in any deuterium that happens to be in its path.

Very earnestly and soberly, they'd emphasized to Candido that this was just the detonator part. They'd cannibalized a Titan missile—one of the thirty or forty that crouched in silos in a circle around Denver—but they'd left off the lithium deuteride part from the thing they entrusted to the tank's handling rig. They'd explained that the idea was to flood the entire volume occupied by the congruency with highly ionized nuclei of high kinetic energy. The plutonium detonator was enough to do this. They thought there was a good chance this would disrupt the condition that maintained the congruency.

Candido wasn't impressed. They just wanted to try it because if they didn't they'd never be sure it wouldn't work. When he was a kid, he'd learned not to play with matches. They hadn't.

But the wind still blew. The floods in Boulder got worse, and no one had a better idea. They worked to convince him that the fail-safe mechanisms would prevent the bomb from going up until they were ready to set it off, and they promised him another hundred thousand. They put it in writing. He made sure his insurance was paid up, and said all right. He still didn't like that thing from a nose cone on the tank's front end, but he liked the extra hundred thousand more.

"If this doesn't do it, I don't think anything will," he said. The roads were roads he'd traveled before—familiar. The force and the gusty blasting, and the abrasive, high-sustained yell of the wind were like an incredible symphony by a modern composer, but a thing he knew so well he paid it no attention. He guided the tank and when they got close enough he put on his breather mask and gave the others time to get their masks on, and then he turned up the supercharger and they went on all the way to the heart of the whirlwind, into the zone of calm. There was some new litter gathered under the sphere, but nothing of any great size or anything that would make any trouble. Even the roundabout path across the pier- and bar-studded foundation was easier. A beaten path. And all the time he was thinking that the only men who could understand the congruency—what had created it and how it was maintained and how it could be erased—had vanished in the instant they made it, and L'Heuroux and all the other men who were trying to devise a weapon against it were fumbling children poking sticks into quicksand. Himself among them.

Ken Storch worked the handling rig with an expertise and care even greater than before—respect, Candido judged, for the power of the thing he was handling. This was something you could understand only by knowing that no sane imagination can really encompass the concept of twenty thousand tons of TNT. Storch was working the rig with the knowledge that its burden was a kind of death so blazing and immediate that even the fact of death would not have time to drive itself into his consciousness before his consciousness was shattered into its component atoms.

The arms of the handling rig withdrew from the bomb, and the bomb crouched squatly on a surface of crushed midden. All of its essential structure was concealed by its casing: they'd insisted on that—even if he were cleared to obtain such knowledge, they said, he had no need to know how it was put together. As if he could understand what he saw if he saw it. As soon as the arms were clear, he backed the tank away. In half an hour, the timing mechanism would arm the bomb—or if that failed, would at least release another mechanism so that a radio signal could arm it—and he intended to be far away from ground zero when it happened.

A tank didn't move very fast.

The bomb wasn't exploded until after they got back to Boulder. Candido and L'Heuroux and Ken Storch were permitted to stand under the rooftop portico of an ornate building while a few yards away in the same shelter a half-dozen men worked to ready the detonating equipment.

It was a lot more sophisticated than the radio they'd used in the tank on their earlier try. This equipment transmitted a beamed, highly intricate, frequency-modulated signal; it was only to that exact signal—and no other—that the bomb would detonate. A small transmitter in the bomb itself had been announcing that it had armed itself—that it waited only for the signal to turn itself into a small, vest-pocket edition of doomsday. The men had been working all morning, preparing to transmit the signal that would do it. They weren't ready yet.

Then, finally, they were ready. In spite of the rain and clouds that made it impossible to see even a quarter mile, Trask passed each of them a pair of smoked glasses and advised them not to look in the direction of the whirlwind's center. Somebody with a parade-ground voice began announcing a countdown.

Candido held the glasses in his hand, then thought better of it and put them on. Always take the advice of someone who knows more about a thing than you do. The countdown paced off the seconds to zero, and someone at the transmitter did something—Candido didn't see because he was looking northwest, toward the center of the whirlwind, nine miles away. He knew someone did something because the sky's gray drabness, dimly seen through the glasses, brightened momentarily like a flashbulb silently bursting its light in a smoke-thickened room. Than it was dark again. After a long time, thunder came.

Candido took off his glasses. The wind was still blowing. Rain still drilled the rooftop in endless, spattering patterns. He cast a skeptical glance to L'Heuroux.

The physicist shook his head. "At this point, it's impossible to say. We have a powerful system here. It will take several hours, at least, to dissipate."

"Then we'll wait," Candido said.

An hour later, the rain was still falling. And two hours later. Three, and the wind blew gusts as strong as ever. All night it stormed. In the morning, the creek's floodwaters had spread to even higher ground. Still the rain came down, and the wind drove smashing waves against the walls of homes and buildings on the flooded land.

Candido lighted his pipe, bent the match double, and —not finding an ashtray in reach—stuck the match in his jacket pocket. They were back in the classroom again, and scrawled on the blackboard was a phrase: *Our daily life, which is all we have.* It was an annoying thing to have to look at, but his chair at the table was faced that way, so he couldn't turn aside. Nor could he change to another chair. Outside, as endlessly as a waterfall, the rain splashed down.

"Can you suggest anything at all?" Trask asked.

L'Heuroux rubbed a knuckle against his nose. "It's proving more refractory than we anticipated. Before we can recommend another approach, we'll have to study the data. I've gathered considerable information during our excursions. When we've analyzed this data, we'll know considerably more about this condition. Then we should be able to define a method of terminating it."

"What you're saying," Candido said, "is you don't know how to stop it."

L'Heuroux gave him an annoyed glance. "For the present, I must admit you are right. However, this is only a temporary state of affairs."

"Lasting," Candido said, "until we don't have any air left." There'd been a call last night. A small well in Kansas had blown and gone torch. He'd packed up his crew—all but Storch—and sent them east to fight it; they weren't needed here. But it was bad business to send them on a job and not go himself; if he didn't at least show on the scene of a job, somebody might get the hunch any man could do that kind of work—well, they could, if they learned all the tricks and had the nerve and more than a man's share of luck. If he let the crew go on too many jobs by themselves, some day there'd be three or a dozen guys in the business. One or two might even be rough competition, once they got themselves known. This job here was using up a lot of time. More than he'd expected, and no end in sight.

"I've got work waiting, other places," he said.

"We have you on retainer, I believe," Trask said.

"Yeh, you do," Candido said. "But I don't think you'll need me for the next forty-eight hours. Unless you've got an operation planned, I'm taking off."

"I believe you don't realize," Trask said, "this is something more than just another job. Unless this thing is stopped, no other work in the world will be worth doing. It's . . . why, it's the air we breathe!"

Candido had other things to do than twiddle his thumbs. "If you've got work for me, I'm here to do it. If you don't, it doesn't matter where I am. You'll know where to find me. I've got your retainer, and I'm on call twenty-four hours a day." He shoved his chair back, preparatory to leaving.

"Dr. L'Heuroux?" Trask asked.

"We'll have to study our data," the physicist said.

Candido rose, nodded to Trask, and turned to leave. He wondered how far his three hundred thousand would go toward building him a home-size, self-sufficient pressure chamber. Maybe he ought to set up a new business, too, selling air by the bottle—delivered to your door like a milkman—to the other people who built themselves pressure chambers. Yeah, he thought sourly—and maybe sell cans of vacuum to companies that made radio tubes. It made as much sense. Maybe . . .

At the door, he turned and came back. "How much is it worth if I stop this thing?"

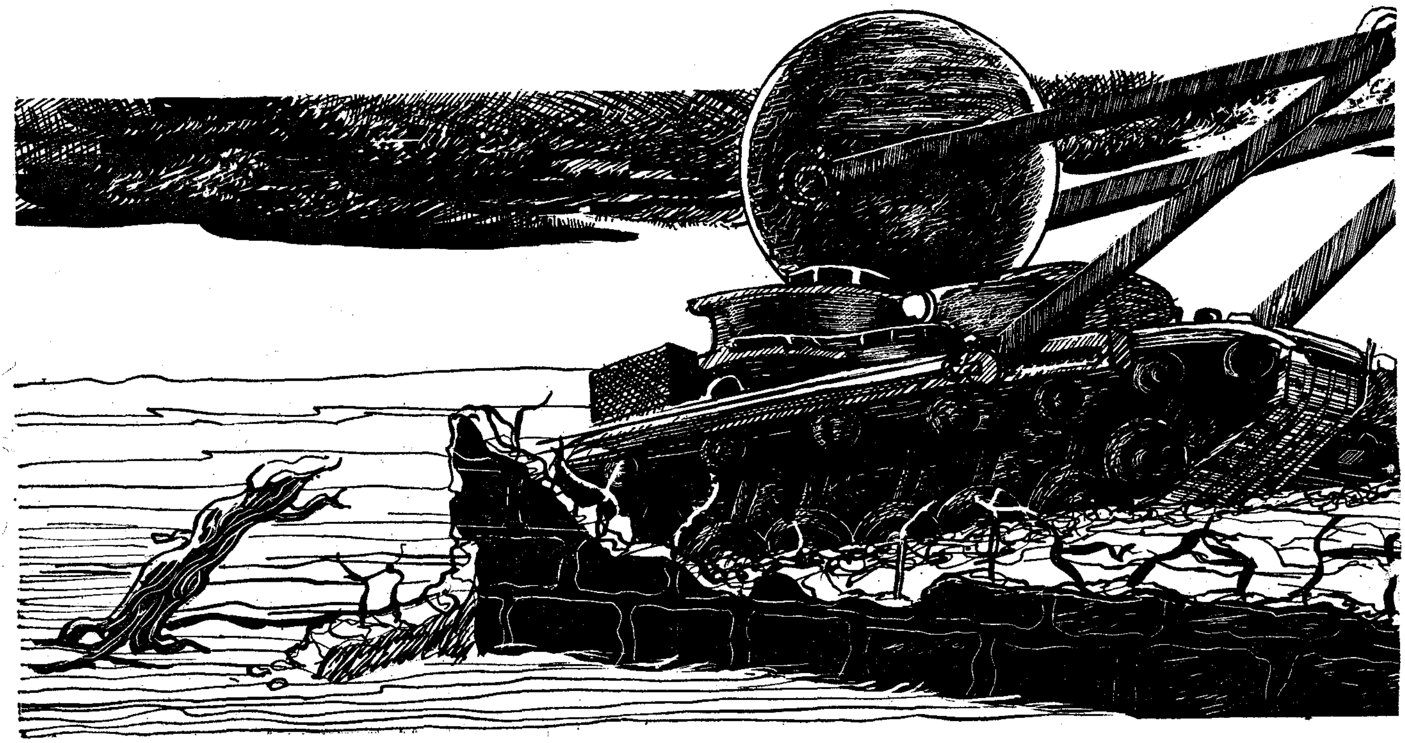
Trask looked up, startled, like a deacon caught reading *Playboy*. "You have your retainer," he said stiffly.

"That's for doing the work," Candido said. "Pulling chestnuts and such. What I'm talking about now is figuring out how to do it."

Trask was suddenly quite interested. "Do you know how?"

"He can't possibly," L'Heuroux said. "He has absolutely no grasp of the principles involved."

"I know how," Candido said. He went around to the window, glanced out at the rain, the wind-wracked trees, and turned and leaned a shoulder against the window's frame. "It just came to me. Your trouble, you've been going at it wrong—like the mathematician when they



handed him the one about how many flies in a bottle."

"I don't know what you're talking about."

Candido shrugged. "It's an old trick-type puzzle. You've got a bottle—say five-gallon size—with a fly in it. And you put another fly in it, and then a second later you put two more flies in, and another second later you put in four flies, and then eight, and so on."

L'Heuroux seized a stick of chalk—scrawled a formula on the blackboard under the phrase about our daily life. "*Geometric progression.* Yes, go on."

"Well, you keep at it," Candido said. "And after three minutes the bottle's exactly full. None left over. All right . . ."

L'Heuroux was scrawing hastily on the board. "What volume does a fly take up?"

"A third of a cubic centimeter," Candido said, and smiled as the physicist went into a frenzy of conversion formulae. "Now, what I want to know is, how full is the bottle at two minutes and fifty-nine seconds?"

The physicist worked quickly. His equations proliferated like ivy vines at east coast universities. Candido let him go on for almost a full minute. "That's enough," he said.

L'Heuroux turned. "Either the flies take up less space," he said, "or the bottle's larger. Considerably larger."

"I was just fudging the figures," Candido said. "They *don't matter. You've been going at it wrong,* just like I said you were. What the guy with the bottle's been doing is doubling how many flies he's got every time. Well, if that's what you're doing, and if you don't have any flies left over after you add the last batch, it figures the bottle was half full the time before."

"Well, of course," L'Heuroux said. "Why yes! Of Course! But what does this have to do with the congruency?"

"Not a thing," Candido said. "I'm just saying that's how you've been going at it—hind end frontwards, and *we say down in Texas that's not the best way to ride a* horse." He shifted back to Trask. "You haven't said. What's it worth if I stop this thing?"

"Dr. L'Heuroux has been advising us as a public service," Trask said.

"He's been getting paid in feeling important," Candido said.

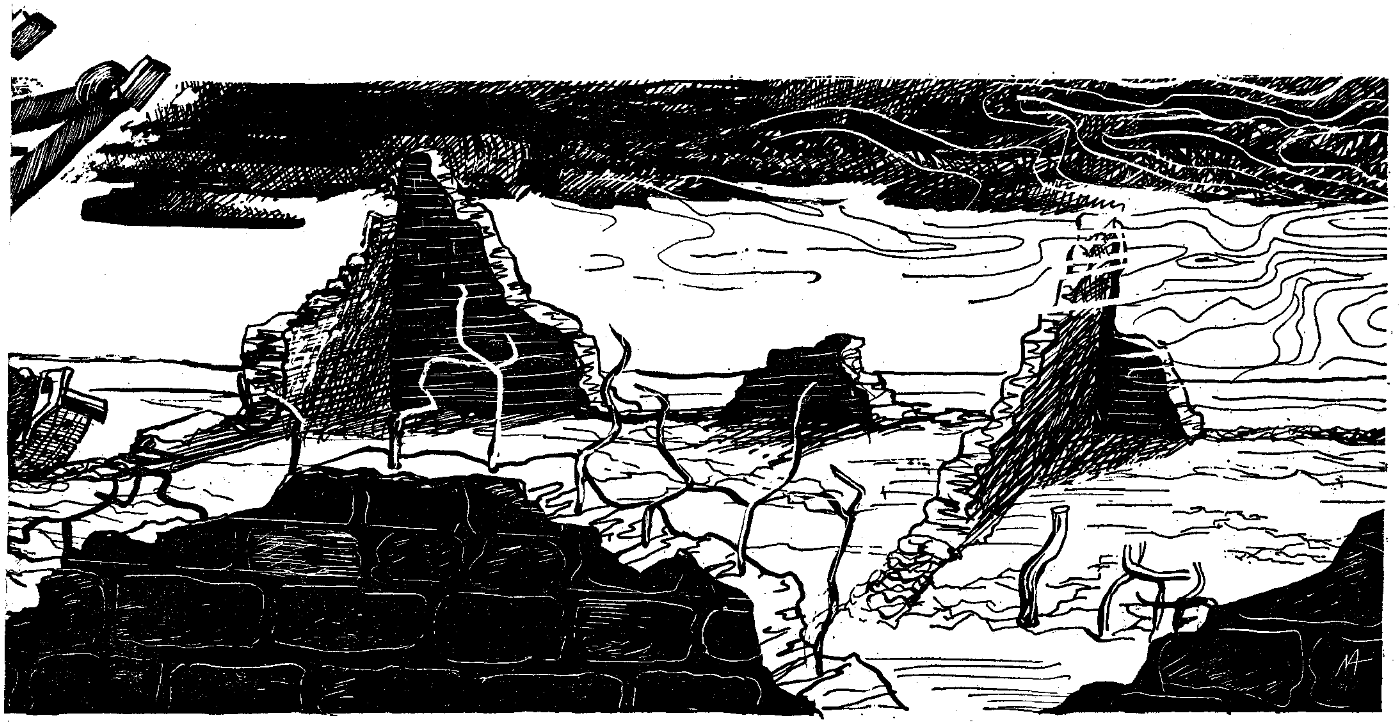
"I deny that!" L'Heuroux spluttered.

He didn't even know better than to interrupt a man who was haggling. Candido ignored the interruption. "You've been getting just about as much as you're paying for," he said. "I'll tell you what I want. I want a clear deed to that chunk of land. I want to own what's left after I've stopped it."

Trask looked like he'd been asked for an option on Brooklyn Bridge. "Is that all?"

"Any objections?" Candido asked.

"Oh no," Trask *said quickly.* "Yes—I'*m sure it can* be arranged. No trouble at all." He was so eager to make the



deal he didn't think to ask what Candido wanted the property for. He was no businessman, Candido thought.

"Shake," Candido said, and stuck out his hand.

Three days later, they were ready. There was a steel mill and fabricating plant in Denver—not an especially big one, but big enough for the job. Mention that it was to fight the whirlwind was all the plant manager needed to schedule the work right away, and as soon as machinery and men were cleared of other jobs they went to work.

Candido went east to Kansas. He was gone only thirty-six hours. It was a routine job, and the fire snuffed at the first blast. He got back to Denver in time to catch four hours sleep before the steel company phoned. The rig he'd ordered was ready.

He inspected the product and pronounced himself satisfied. It was fast, good work. He shook the plant manager's hand. This was a man who knew how to do business. The new equipment was loaded and trucked north to Boulder. They worked all night, and at ten in the morning the tank was ready to go.

It looked only a little like a tank now. More closely, it resembled a beetle with a domelike shell steeply canted on its back, and paired grasshopper legs projecting their knees forward at about the angle flags are carried on parade. The tank itself was small under all that. He just hoped the wind wouldn't be too strong against it. He'd have to hold tail to the wind all the way in. He hoped the Diesel would have power enough to drive the rig when they got there.

"Might as well start," he told Storch. He nodded to L'Heuroux. "Come along. You'll see the way to do it."

Proudly, L'Heuroux declined. Candido and Storch were alone in the tank when it left Boulder, groaning under its load. It was hard going. The wind drummed on the carapace, and though its round surface was like a shield to the wind, it was like a sail also, forcing the tank headlong forward. He'd had to plan out the way they'd go, studying large scale topographic maps until his eyes burned. He had to know that nowhere ahead was there too steep a slope, too sharp a declivity, nor any obstacle the tank couldn't clear—for once he began to move with this load, he was committed and could not turn aside. To let the wind get its teeth around the edge of the carapace would be disaster. The tank would be thrown like a tumbleweed, wrecked, and they'd be helpless in that hurricane wind.

The rain-sodden earth bogged under the treads, but the wind kept the tank moving. Candido kept an eye on the pennon he'd fixed to the tank's prow, showing him the bearing of the wind. He kept the pennon whipping straight ahead. He had a quadrangle map taped to the panel in front of him. The route he'd planned was traced on it boldly. He watched for landmarks. The wind sang like a chorus in rage. The tank rocked and lurched and jolted. Blasts of wind shook it like a bone being gnawed.

The land was slopes and dells, and irrigation canals carved along the winding shoulders of low hills. Most of the canals were hardly more than ditches, easily crossed. One was a deep, slow river, full to its banks and flowing over. The bridge was where the map showed it, and wonder of wonders it held the tank's weight. He'd checked as much as he could, but the tank was a lot heavier than anything the bridge was built for. Until he was over, he hadn't been sure.

He'd started from Boulder almost straight east. The wind curved north and he turned with it. The tank crossed the southernmost extreme of Gunbarrel Hill and descended again to the plain beyond. Wire fences that had stood to the wind went down under the tank's weight. A cornfield, cut to stubs by the wind, streamed dust like the smoke of a brushfire. Wrecked foundations of barns and homes lay like open graves near the roads, now and then giving up another fragment to the tearing wind. The tank turned north and then westward, and passed north of Gunbarrel Hill, and turned south again. The spiral was tighter now. Swinging east again, the tank mounted the Hill's slope. The wind was like a powerful fist putting steady, driving pressure at the tank's rear. He should have given the tank some kind of an upward projecting spine, Candido thought, like a sailboat's jib, to help hold the thing butt to the wind. Too late to do it now. The tank crossed a small watercourse—dry now—bumping on the rocks and creaking with internal stresses.

They came to the crest. He could see the congruency's sphere off to his left, but he couldn't turn toward it. Keeping the wind behind him, he circled it widely. Then again, more closely. The foundation of the laboratory building was the final obstacle. For this and all its hazards there could be no evasion. The only way to go was straight in. The best he could do was possibly to sidle past the most forbidding obstructions. Candido studied the path ahead, trying to estimate the best possible path for the tank's treads. Bent stubs of steel bar gleaned rubbish from the wind like fangs raking flesh; they could as easily slash the tank's treads—break them. It was hard to make the brakes hold. He could hardly slow the tank's ponderous, headlong drive.

A thump and a lurch, and the tank mounted onto the platform. A crunch and a long, slowing grind as the tank straddled a pier and crumbled it under its belly. Candido felt something break. He wondered if it was part of the tank or the pier. The tank barged onward, bumping and lurching, and he had to work on the brakes to keep the tank square to the wind. Suddenly he felt something else give.

But the tank was in the dead zone now, under the sphere. The wind's seethe was like sawteeth, snarling, but now it was without force. Candido realized he hadn't put on his breather mask, and his ears felt plugged by the low pressure. With numb, fumbling, trembling fingers he got his mask on. He breathed deeply, only now aware how badly he needed it. His blood seemed to vibrate and burn.

He signaled to Storch, and the younger man unlocked and opened the turret-top hatch. Leaning far back, Candido could look up through the opening and see the sphere overhead, whirling like a model of the planet Jupiter. He shifted the tank back and forth, hitching it around until, finally, he was satisfied. The tank had to be in just the right position. Everything had to be just right. When he was satisfied, he put a hand on Storch's shoulder. He nodded.

"Ready," he said. The mask changed the word to a mumble, but Storch understood. The younger man checked the handling rig—modified again for this job—as carefully as if it were a supersonic aircraft. Only when he was satisfied did he put it in gear, to take power from the engine. Candido swung his periscope around to watch.

The hoodlike carapace separated into two hemispheres, like a beetle putting back it's wing covers to fly. Fingertip-held between paired booms, the turned bowl upward and extended like ladles, one to each side, as the booms straightened out from their original hairpin bend. With a hard snap, the booms locked straight and the hemispheres—until now swinging free—locked level. Rigid, Candido thought, and let himself breathe again.

Storch shifted to another gear. Slowly, for the hemispheres were heavy and the gears had been rigged to account for that, the booms hinged upward. Candido revved the Diesel. It changed the speed of the hemispheres' rising hardly at all. Minutes—it seemed like days—passed. Candido thought grimly of the joke about you'll never get it off the ground, and all he could hear was the Diesel's growl and the cry of the wind and the creak of metal joints under strain. The wind touched the lips of the hemispheres. The tank vibrated. Something buzzed resonantly.

Candido cracked the throttle full open. The engine erupted. The hemispheres lifted like the wings of a startled bird, and suddenly the wind caught them and swung them upward in arcs on the ends of their booms. The clang as they met overhead was like the gong of doom. It burned the ears like dentist's drills.

Abruptly, wind battered the tank. Thunder drummed. Candido's ears popped with a sudden jump of pressure. The thunder boomed on and on, as if they were sealed in a room with giants pounding on the walls. He could feel the impact of the sound on his body. It was like being shaken like a child's rag doll. Slowly, by degrees, the thunder melted away.

Candido took off his breather mask. Not needed now. The air was full of dust. It smelled musty. Through the open hatchway, he could see the steel globe enclosing the space where the congruency had been—where it might still be, for that matter, inside that steel container. He breathed deeply. Not until now had he been sure the two hemispheres would meet and fit together without smashing each other, or without one or the other overshooting and passing into the congruency. But the engineers who'd worked on the thing had designed well. Neither had happened.

He climbed out of the tank. The wind still blew, but now it was only a gentle, warm wind. In all directions, storm clouds grayed the sky. As he stood there on the tank's superstructure, it began to rain. He got back inside. He closed the hatch against the torrent.

"We stopped it, Ken," he said. He opened the lunch pail he'd packed and handed a sandwich to Storch, took one himself, and poured himself a cup of coffee from the thermos. "The wind's still blowing out there," he said. "We'll have to stay here a while."

The jeep came, at last, in the last dim vestige of twilight. Its headlamps glistened on the wet concrete of the foundation, but the rain had stopped, finally, more than an hour ago.

By that time, Candido had been able to look the tank over. The treads had lost a total of seven shoes. Several more were badly torn. In two places, the linkage of the left tread was partly broken. A few more yards and likely the tank would have been immobilized. He felt numb and tight-skinned, thinking about that.

The congruency was still there, inside the steel shell. The hemispheres hadn't sealed perfectly, and a trickle of air was leaking in through the crack. Trask and L'Heuroux climbed out of the jeep and approached. Candido leaned against the tank and let them come. They picked their way across the hazards of the wrecked foundation with a flashlight, even so stumbling from time to time. When they got there, at first they said nothing. Trask beamed the flashlight upward and played it over the steel globe's surface.

"I checked," Candido said. "No fractures. It'll hold, at least till we make a tighter one."

"Of course you realize," L'Heuroux said, "the congruency is still there, inside. This doesn't solve the problem."

"Doesn't it?" Candido asked. "Gentle breeze, we've got now." Actually, it was blowing a stiff twenty miles an hour, but the point was made. "When I've got a boat that leaks, I plug the hole."

The flashlight beam fixed on something that protruded from the globe's underside. It was a short length of pipe, with a valve wheel beside it. "What's that?" Trask asked.

"Just what it looks like," Candido said. "A storage tank's no good without an outlet."

"Outlet? Storage? I'm afraid I don't . . ."

"I'm starting a new business," Candido said. "That's why I wanted this chunk of land. I'm going to sell vacuums—the emptiest vacuums anywhere in the world. How much do you think they'll pay for a gallon of real nothing—no impurities?"

Another thought came. He smiled. Maybe he'd lay a pipeline—maybe all the way to the east coast. Plenty of people would pay for a vacuum you get just from turning a faucet, and he had an unlimited supply. Should be a real good business. ■

CRACKPOTS, INC.

RICHARD L. DAVIS

Evaluating crackpot ideas is inevitably extremely difficult; any breakthrough requires a new approach to old problems—and 99.99% of them are nonsense. And the remaining fragment may not be at all what the inventor suggests . . .

The Old Man grunted at Miss Alicia and went on into his private office. Pausing inside the door he glared at the coat tree as he carefully hung up his hat, slipped out of his coat and dared the coat tree say anything in rebuttal as he placed his coat on it. Shuffling over to his desk, he lowered himself into the steel and plastic swivel chair and reached for the cup of coffee on the desk pad.

"Too hot!" But the level in the cup dropped rapidly at each noisy gulp and just as he turned the cup up to drain the last drops the door opened and Miss Alicia walked in with a stack of papers in hand.

"Good morning, doctor," she said blandly.

"What's good about it?" he wanted to know.

"Mr. Harris would like to see you this morning. I gave him an appointment for ten thirty."

"What's that young pup want?"

"He said he had one you might like to see. He'll bring it with him," she said placing the papers on the desk.

"Anything else?" he said as Miss Alicia picked up the empty coffee cup.

"The Directors' meeting at two and Major Bunning will be here at four. The major said he would drop you off on his way home, if you're ready to go at a decent time."

With the closing of the door as Miss Alicia went out, the morning ritual which varied little from day to day, year to year was completed. Now Old Doc McCleary settled down to the boredom of working his way through the pile of reports, summations, and directives left on his desk by Miss Alicia. Scanning and initialing, pausing now and then to growl at some unusually stupid piece of paper, the unused portion of his mind started looking forward to Harris' visit. That might prove to be very interesting.

In the three months Harris had been here, only twice before had he had the temerity to beard the Old Man in his den and each time he had had something. It was beginning to look like that youngster was a comer. The Department of Crackpot Inventions, as the Old Doc was wont to call his domain, could use more of Harris' kind. He seemed to have that unidentified something which didn't show up in tests but was needed so badly in this type work. So far, Old Doc had been able to find four others with the ability to scan through hundreds of disclosures discarding the trash from true crackpots but able to unerringly stop when that one-in-a-thousand usable idea lay before them. It would be nice if young Harris did work out. Perhaps they might whittle the backlog down some.

Promptly at ten thirty, Miss Alicia ushered the tall, slightly stooped Harris into the August Presence.

"Sit down," grunted Doc McCleary. "What great earth-shaking invention have you uncovered this time?"

"Well . . . ah . . . I'm not sure it's something valuable but you told me to bring anything to your attention which wasn't . . . ah . . . that . . . ah . . . I couldn't bring myself to throw in the waste basket."

"Yes."

"Well . . . ah . . . this man has built a machine which can't work. That is, it shouldn't work but it does. At least the man claims it does. I thought you might be interested."

"What man?"

"A Mr. George Humphrey Jones. He lives in Kentucky."

"What does this wondrous machine do?" asked Dr. McCleary.

"Well . . . you see, sir, it seems to be a perpetual motion machine," Harris said lamely.

"What?" Perhaps he had been wrong about Harris.

"That's what I thought, sir. Perhaps I shouldn't have bothered you. I'll go on back."

"Sit down!" barked the old man. "What made you think I'd be interested in this perpetual motion machine?"

"I suppose I shouldn't have thought so, sir, only there's something odd about this one."

"Oh?"

"Yes, sir. You see," said Harris unfolding a rather large print, "he has built a machine like this and all he does to start it is twirl this flywheel. After that, according to what Mr. Jones says, the machine just keeps on running."

"Umph."

"I know it's impossible to make such a machine work," said Harris musingly, "but here's what made me wonder. See these two terminals? This is even more preposterous. Mr. Jones says he can hook up an electrical load to the terminals and get usable energy."

"He can?"—skeptically.

"Yes. He says he uses it to play his radio. He doesn't have electricity on his farm."

"Runs his radio with it?"

"Yes, sir," replied Harris. "And he has tried it on light bulbs and it works fine he says. In fact, just to find out how long he could get electricity out of it before it ran down, he left a light bulb hooked up to the machine for seventy-three days."

"Finally ran down, huh?"

"No, sir. The bulb burned out. The machine was still running."

"What makes the contraption work?" asked Dr. McCleary becoming interested.

"Oh . . . I didn't say it does work, sir. I just thought you might be interested. Mr. Jones, though, has a vague idea he can tap 'cosmic energy' with it. Of course that's silly."

"Of course it is," said the old man. "Have you any idea how it might work if it did? No? Then what's wrong with cosmic energy?"

"Ah . . . I don't know, sir," said Harris taken aback.

"Let's see," said Doc McCleary returning to the diagram, "he seems to indicate a couple of carbon brushes here on the flywheel. That could generate current. Uh-huh. Leads to the posts, too. That doesn't explain what makes it keep on running, though. Tell you what. Give this to the boys down in the shop and have them throw us one together."

The first Friday of every month the Director held his monthly meetings so he could show everyone where they had been and where they were going. Old Doc McCleary was just as bored at the meeting as he had anticipated. Perhaps even more so. Once more the evidence as to why he would never be a director was placed on view. Old Doc could get a job done, could pick the men needed to perform a task, could extract nearly blind obedience from his men, but never would he be able to keep the precise little records, design the beautiful charts and graphs so dear to the heart of a director. Old Doc was wont to say "Joe is better than Bill" because Old Doc knew it, but put the reasons on paper, so he could show others why, he couldn't. Old Doc's system was seldom wrong but the system was looked at askance and the system couldn't be allowed to spread so Old Doc would remain a department head while the keepers of neat evaluation charts and achievement indices would pass him over from year to year.

Well, at least Old Doc's department showed up fairly well on the little charts this month since the bright young minds in Engineering had come up with a practical application for magnetized glass. It made Engineering look good, too. Umph. That magnetized glass idea had been gleaned by Harris. Old Doc had been even more skeptical of that than this perpetual motion thing.

The meeting finally broke up and Old Doc decided to wander down to the shop to see how things were coming on this latest idea. Picking up a phone, he dialed his office and told Miss Alicia where he could be reached, then took the elevator down to the tube. A short ride on the ambulator and he arrived at the experimental shops.

"Hello, Doc," Dave Robbins greeted him, "what brings you down here? Trying to learn how it's really done?"

"Humph! Wise guys I can do without! Who's working on Harris' project?"

"Well, things were a little slow so I took it on myself. Besides, I thought it best to have the best on it."

"Best compared to what?" asked Old Doc. "How far along are you?"

"Just about ready to fire up," said Dave. "Most of the parts in that weirdo were standard so we just took them off the shelf. I don't care what you guys have come up with before, this thing looks like a bust."

"Where is it?"

"Over in B shop. Come on. Let's see if my boys have it together yet."

Coming in the door, Dave waved his hand out and said, "There she is, Doc. Kind of expensive piece of junk, wouldn't you say? Four hours each for five high-priced type techs plus parts. How long before we can try it out, Woody?"

"Just as soon as I tighten this nut."

"Doc," said Dave, "Harris wanted to be here when we tried it. O.K. if I call him?"

"Uh-huh," said Old Doc as he walked over closer to the machine. It did look like a Rube Goldberg type. The more he looked, the more doubtful he became. For his own sake as well as Harris' he hoped this contraption worked. Dave had been joking about the expense but the Director wouldn't joke! The amount spent would be a minute fraction of the total budget but the Director hated seeing even one nickel go without a good sound reason and hunches weren't good sound reasons.

"Here comes Harris now," said Dave looking out the glass door. "Didn't know he could move that fast."

"Oh, Dr. McCleary, sir," gulped out Harris as he burst in the door. "I didn't know you were here."

"I hope I have your permission?" said Doc McCleary sarcastically. "I am slightly interested in my department's activities, you know."

"Oh, yes, sir," said Harris looking toward the machine. "Is it ready?"

"I said it was," said Dave blandly. "Who's going to twist the wheel?"

"I believe the honor goes to Mr. Harris," said Old Doc.

"Ah . . . thank you, sir," said Harris approaching the machine." It doesn't look like much, does it? It doesn't look like it'll do much of anything, does it?"

"Get on with it, man! Spin the wheel!"

"Yes, sir," and he gave the flywheel a gentle turn. The machine clattered a little and the flywheel made several revolutions before coming to a stop.

"Oh, come on man," exploded Old Doc, "give it a good spin!"

"Yes, sir."

Grasping the flywheel firmly, Harris gave it all he had. The machine chattered and talked to itself, spun merrily along for a bit, than slowed to a stop.

"Here. Let me at that thing!" said Old Doc, and gave the flywheel a vicious yank.

Chatter, clank, stop!

"You sure that thing's put together right?" asked the Old Doc turning to Dave.

"Doc! You know my boys!"

"Yeah. Sorry, Dave. Maybe something's binding."

"We'll check it, but I'll bet on it! How free do you expect this bunch of junk to run, anyway? Look. The flywheel moves easily, no binding. It feels free as I ease it around. Now, show me some other way to test it and I will!"

"O.K., Dave. No use getting overheated. Looks like we struck out. It was crazy anyway. How about it, Harris?"

"I don't know, sir. Somehow, this machine doesn't feel like the drawing. I know this thing won't work, but I wouldn't say that about the drawing."

"What!" exploded Old Doc. "The drawing works but the machine doesn't?"

"Ah . . . I didn't mean it quite like that, sir. I . . . ah . . . I don't know what I do mean, but there is a difference!"

"Humph! Dave's crew could build a flitter from a photo of the outside and every screw would be right!"

"I know that, sir. I suppose I'm being stupid but I know if I had seen this machine instead of Mr. Jones' drawing, I wouldn't have bothered you. I'm sorry, sir."

"Sorry! Humph!"

Fortunately for Harris, the phone rang and Dave passed it to Doc McCleary.

"For you. Your office."

"Hi, Dad," a familiar voice came out of the only interplant phone. "How long are you going to be?"

"I'm ready to go right now! Talk about wasted afternoons! I'll be right up."

As Old Doc stomped out, Dave turned to Harris. "Man, like I wouldn't like to be in your shoes."

"Uh . . . ah . . . me, too," said Harris as he left, too.

"Miss Alicia," said Old Doc as he stormed into his outer office, "I'm on my way home! If anyone wants me, I've gone to the South Pole on a fishing trip!"

"Yes, sir," said Miss Alicia blandly. "Should I call for reservations?"

"Humph!" as he slammed into his private office. "Oh, hello, Bill. Sorry to sound so grouchy but that . . ." and with that he launched into a tirade covering the afternoon which lasted halfway home.

"Say, Dad," Major Bill Bunning interrupted at a pause as they flitted along, "why don't you come on out to the house and have dinner with Helen and me? I'll lay six to five the kids will make you forget about Harris and his machine in ten minutes flat."

"No, thanks, I'm in too foul a mood. I'd probably ruin the evening for you and Helen and I'd probably scare my grandkids half to death."

"Nonsense," said Bill reaching for the phone and dialing his home number. "Hi, darling," he said as his wife's features appeared on the tiny view screen, "I've got your father with me and I've about decided to bring him home with me. What say?"

"Wonderful. It's about time he came out and reported in to the kids. They've about forgotten they have a grandfather. How long will you be?"

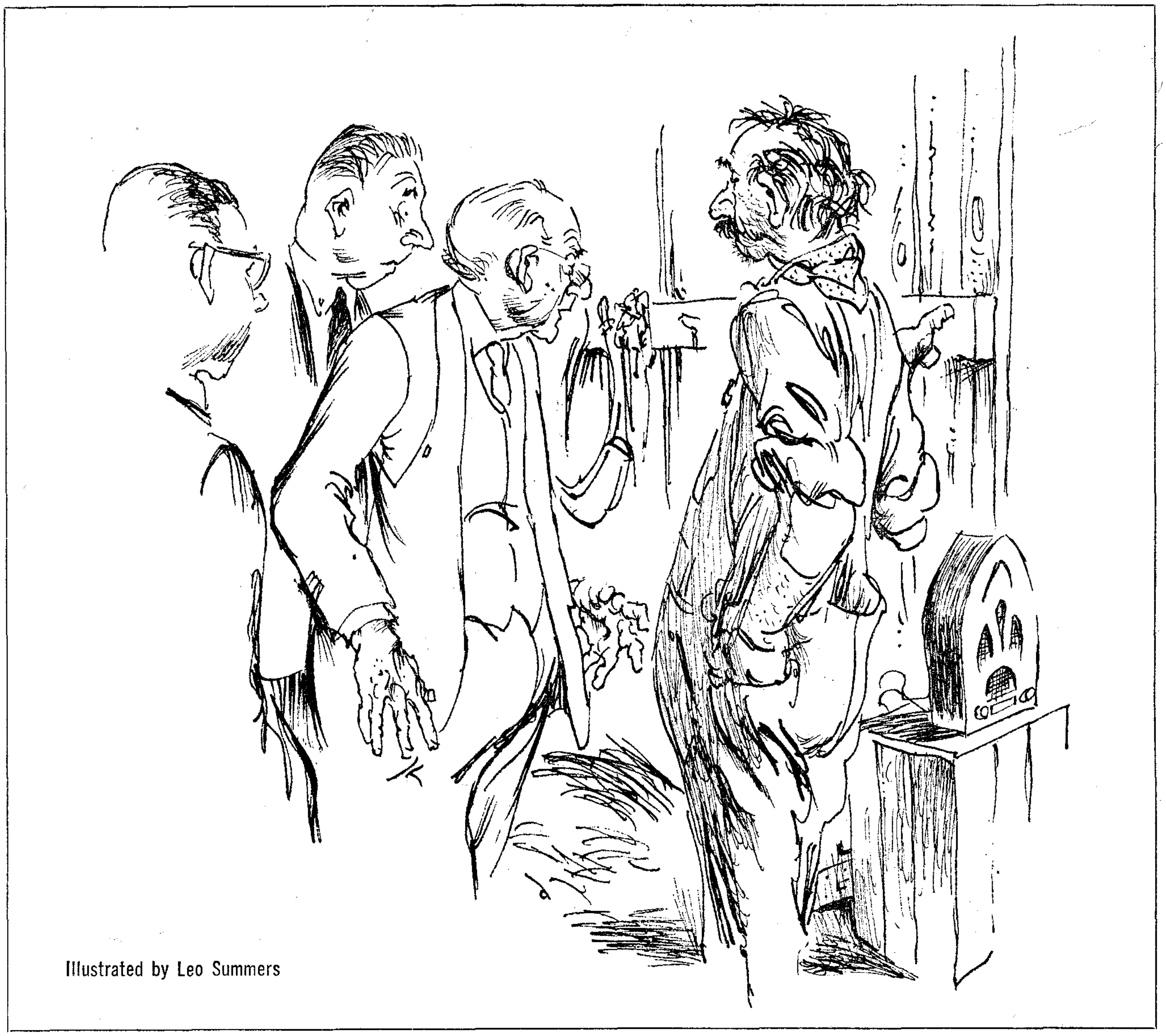
"About five or ten minutes."

"Fine. You two can relax a bit before dinner then. See you," she said pursing her lips in a kissing motion.

"O.K., Doll. Bye."

"See. All settled," Bill said turning to Old Doc.

By the time the two men got to their after dinner cigars,



Illustrated by Leo Summers

Old Doc had mellowed somewhat and could return to the subject of Harris' boner without bursting a blood vessel.

"I just can't understand Harris pulling a goof like that," Old Doc was saying. "I'd have bet anything he was right even though I couldn't see how that thing could possibly work myself."

"Heck, Dad," put in Bill, "anyone can make a mistake."

"Not my people," said Old Doc. "They don't make mistakes like that. They can't."

"Ah, Dad! What do you mean, they can't make mistakes?" asked his daughter.

"Well, it's something that's hard to put into words," said the old gentleman. "Look at it this way, we get thousands of ideas from thousands of crackpots. We also occasionally get an idea from someone who isn't a crackpot. It looks like a crackpot idea—only it isn't. How do we decide which is which?"

"It's always looked like an impossible job to me," said Bill.

"For most people it is an impossible job," said the old man, "but every once in a while a man comes along who can look at all those crazy, crackpot ideas and pick out the ones that aren't crazy, crackpot ideas. I don't know how it's done, but, if a person has the talent, he doesn't make mistakes. If he makes mistakes, he doesn't have the talent. It looks like Harris doesn't have the talent."

"Don't you screen them some way?" asked Helen.

"Of course," replied her father, "We screened Harris. I had the others check all his work for the first two weeks he was with us and they spot-checked him for the first two months after that. And he was right on the only two ideas he picked out in that time. Based on all I've found out up to now, Harris had it."

"Couldn't there possibly be some slight difference between the machine you've built and the one that farmer built?" asked Bill. "I know my people would be mighty interested in that thing if it did work."

"You don't know Dave Robbins and his crew," replied

Old Doc. "Still, those drawings were crude. Hm-m-m. I wish I could see the original."

"Where does this character live?" asked Bill.

"Down in Kentucky somewhere."

"Well, heck, Kentucky isn't too far. Let's go down and take a look."

"Don't be silly!" snorted the old man reverting to form. "Flit all the way down to Kentucky to look at a crazy machine that can't possibly work?"

"Oh?" said Bill. "You said yourself that on the face of it, Harris should be right."

"He's new. Besides, I don't know where in Kentucky."

"I'll bet you could find out," said Bill.

"I suppose I could call Miss Alicia at home and see if she could get hold of someone who might know. No! It's too crazy!"

"There's the phone," said Bill.

"Well . . . all right," said Old Doc picking up the phone.

"Hello, doctor," said Miss Alicia as the picture cleared on the viewscreen. "I wondered when you'd call."

"What made you think I was going to call?" grunted Old Doc.

"Mr. George Humphrey Jones lives three miles south of Blackfield, Kentucky. It's easy to find his place. It's buried in a hollow and his barn has a purple roof," she said sweetly.

"A purple roof!" he exploded.

"Yes, doctor. Will that be all?"

"Y-yes," he sputtered, "but how . . . ?"

"Goodnight, doctor." And the viewscreen went dark.

"Blasted female!" growled the old man. "Getting too big headed if you ask me!"

"Well," said Bill, "you might as well sleep here so we can get an early start. I'll have your apartment send out a few things."

The sun was two hours high as Bill's flitter clucked its way over the central hills of Kentucky. In the hills below were little isolated communities where people even today lived much as their ancestors had lived for generations. Little pockets around which civilization had washed leaving the people here little changed.

"That's Blackfield below," said Bill. "Three miles south, wasn't it?"

"Uh-huh," grunted Old Doc. "There's a barn with a purple roof. Umph! Purple roof!"

"I suppose I can let down in the yard. Don't see any other place close, do you?"

"No. Can't expect these people to have a proper parking place. Hey! Look out!" the old man yelled as out of nowhere another flitter suddenly veered in front of them and headed for the farm below. "What kind of fool is that?"

"I suppose I should have had the radar turned up," said Bill, "but who'd expect a traffic problem out here? That character's sure headed for a washout some day. Suppose that's your Mr. Jones?"

"If it is, I know this is a fool trip we're making," grunted Old Doc.

"Hey, look!" said Bill. "Look who's climbing out."

"Harris!" snorted Old Doc. "What's he doing down here?"

"Probably the same thing you are," said Bill. "Let's go down and see."

As soon as Bill set the flitter down, Doc McCleary jumped out and, followed by Bill, headed for the house where the door was just opening to Harris' insistent pounding.

"Well, what do you know," said the little old lady behind the screen, "we've got visitors. My. City folk, too. Howdy?"

"Hello," said Harris. "Is this Mr. Jones' place? Mr. George Humphrey Jones?"

"Why, no 'tisn't," said the old lady.

"Oh, darn," said Harris. "Well, can you tell me where Mr. Jones lives?"

"Yep."

"Well, where does he live?" asked Harris as the old lady remained silent.

"Right here."

"I thought you said this wasn't his farm," said Harris.

"Didn't. You asked was this the Jones place. This is the Cline place."

"This is the Cline place but Mr. Jones owns it?" Harris was slightly confused.

"That's right. They's only been Joneses on the place for a little bit. Let's see. George's granpappy I think it was. Yep. That's when it was. My, aren't you the excited one. And those two behind you, too."

"Mam," broke in Doc McCleary, "can you tell us where we can find Mr. Jones?"

"Which one?"

"Why, Mr. George Humphrey Jones, of course," said Old Doc.

"Why didn't you say so? Yep."

"Well, where is he?" exploded Old Doc when the old lady volunteered nothing more.

"Now don't you go getting snippy with me, young man," snapped the old lady.

"Y-young man," sputtered Old Doc. "I'm sorry, Mam," he said calming himself a bit, "would you be so kind as to tell us where we might find Mr. George Humphrey Jones?"

"That's better. You catch more flies with honey than with vinegar. Young people just don't have the proper bringing up any more. I suppose it ain't your fault, though."

"Mam," said Old Doc barely containing himself, "I don't want to seem unreasonable, but it is important that I see Mr. Jones. Will you please tell me where I can find him?"

"Might try the barn. 'Course, he might be out in the fields. Ain't likely, though."

"Let's try the barn," said Bill.

"Harris," said Old Doc as they found their way around the house, "I suppose you know you near killed all three of us?"

"Killed us?" said Harris vacantly. "I'm sorry, sir. She didn't seem that dangerous to me, sir."

"I mean when you flew in front of us, you idiot!"

"Did I fly in front of you?" asked Harris innocently.

"Forget it!" sputtered Old Doc and stomped on muttering to himself.

As the three neared the wide barn door, faint strains of hillbilly music reached their ears and peering into the gloom within, they could discern an old wooden table radio on a rickety box just inside the door.

"Mr. Jones?" called out Bill.

"Yep." A head raised up to their right.

"Mr. Jones, I'm Dr. McCleary from the Department of Applied Science," said Old Doc.

"Oh, you're that feller I wrote to about my invention," said the rather sparse individual coming out of the stall. "I reckon you've come to dicker?"

"Well, not exactly," said Old Doc. "We've come to look at your invention."

"Well, there she be," said George Humphrey pointing behind them.

There behind the box holding the radio was the twin to the machine built in the shop the day before. Twin? No. This one clattered merrily along and two wires led from binding posts on the machine to the radio.

"No! It can't be!" exclaimed Old Doc.

"That's the machine that was in the drawing," said Harris smugly.

Old Doc literally ran over to the machine and stood fascinated. Getting down to examine it closer. "It looks just like the one we built."

Bill slowly walked around the machine, scuffing in the straw, looking for the hidden gimmick.

"You fellers built one, too?" asked George Humphrey. "How'd you like it?"

"Ours didn't work," said Harris. "I suppose we made an error somewhere."

"Ah . . . you probably just didn't hook up the cosmic energy," said George Humphrey. "I told you in my writing you had to use cosmic energy to run it."

"Cosmic energy?" asked Old Doc.

"Sure. You know, that stuff they's always putting ads in the magazines about. Only it ain't untapped like they say. We use it all the time."

"You do?" said Old Doc.

"Sure. We ain't so uneducated out here. Cousin Alex is the one that figured out they was saying it was hard to get to so they could sell some books or something. Cousin Alex's hard to put one over on."

"Do you mind if we take this outside so we can get a better look at it?" asked Bill.

"Go right ahead," said George Humphrey. "Better let me take my wires off first though."

"Careful there!" said Old Doc. "You're liable to get a bad shock."

"Ain't never shocked me yet," said George Humphrey as he calmly unscrewed the binding posts and took the wires off. As the first wire came loose, the radio stopped playing but the machine kept turning. Old Doc noticed there wasn't a spark between post and wire, though.

"Ah, Mr. Jones," said Old Doc, "how did you go about designing this machine?"

"Well . . . it was kind of accidental like. I dickered with Cousin Elby for that there radio and when I got it I didn't have no electricity to make it play. I just whomped this up so I could play my radio."

"What made you contact us?"

"Oh . . . the paper had a little piece in it about how you folks was always looking for some certain kinds of things. It said you wanted to find a cheap way of getting electricity. I figure this is about as cheap as any. Sure wish you had a use for a no-air machine, too."

"No-air machine?" asked Old Doc.

"Yeah. I dickered for one of them milking-machine things and it runs on no air. I had to build me a machine to make it."

"May I see it?" asked Old Doc.

"Sure," said George Humphrey. "It's right back here in the barn."

Bill and Harris were busy examining the machine which had brought them down here but Old Doc decided to follow George Humphrey back into the barn.

"See. There she is," said George Humphrey. "This one runs on cosmic energy, too."

"It has a flywheel something like the other one," commented Old Doc.

"Yep. They're getting kind of hard to get ahold of, too," said George Humphrey. "This one's off an old Case tractor I dickered for. Kind of wish I hadn't taken it off now. I'm going to have to find me another one to put on the tractor so's I can use it."

"Could I see this one run?" asked Old Doc.

"Sure," said George Humphrey and the machine started running.

"How did you start it?" asked an amazed Dr. McCleary.

"Oh, it starts just like the other one. I just gave the flywheel a little turn."

"B-but you didn't touch it!"

"You don't spin it by hand," said George Humphrey. "You use cosmic energy."

"Hey, Dad," called out Bill, "where are you?"

"Back here."

"Doggoned if I can find out the gimmick on that thing," said Bill as he came up.

"I think I have," said Old Doc.

"You have?"

"Uh-huh," said Old Doc. "I think the Department of Crackpot Inventions is about to branch out." ■

SYNOPSIS

The House of Atreides, ordered by the Padishah Emperor to give up its water-rich planet of Caladan, has taken over the rule of the desert planet of Arrakis (Dune), a place of so little free water that moisture *is wealth. The move appears a victory over the Atreides' ancient enemies, the Harkonnens, who had ruled on Arrakis, because the planet is the sole known source in the universe of the costly geriatric spice, melange. This is mined from sands guarded by gigantic worms and by bands of Fremen, the wild desert folk who live outside the Arrakeen labor pool.*

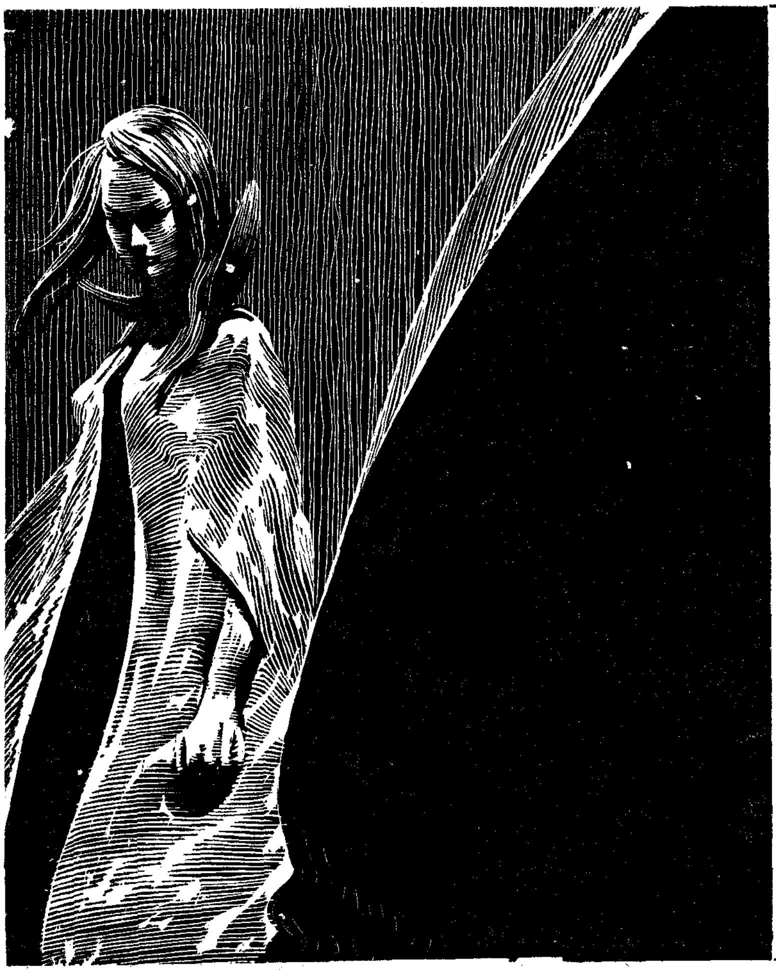
Accompanying the Duke Leto Atreides are his fifteen-year-old son, Paul, and Paul's mother, the Lady Jessica, a bound concubine trained by the Bene Gesserit Schools.

Paul has been subjected to the gom jabbar *ordeal of pain by the Reverend Mother Gaius Helen Mohiam, a Bene Gesserit Proctor and the Emperor's Truthsayer. She sees Paul's latent abilities as a Mentat human computer and concedes he may even be the* Kwisatz Haderach, *a human male of great mental powers for whom the Bene Gesserits have been selectively breeding over a period of many centuries.*

The Lady Jessica, ordered to bear a daughter to the Atreides, bore a son because her Duke wanted an heir. This infuriates the Reverend Mother, who sees little hope of survival for either Paul or his father.

Paul is being force-trained by his mother in the Bene Gesserit Way of mind and body control, learning to use even his Voice as a weapon. His other training is being directed by his father, by the Mentat Master of Assassins, Thufir Hawat; by the swordmaster, Duncan Idaho; by the troubadour-warrior, Gurney Halleck, and by Dr. Wellington Yueh, a traitor in the pay of the Harkonnens. Yueh, forced into his deadly role, has given Paul an Orange Catholic Bible, a gift which reawakens the boy's sense of Terrible Purpose.

Plotting against the Atreides are the Emperor Shaddam IV, who fears the Duke's popularity; the Baron Vladimir Harkonnen, a controlling force in the CHOAM Company which monopolizes distribution and sales of melange; the Baron's young nephew, Feyd-Rautha, and the Mentat-Assassin, Piter de Vries, a man addicted to melange. Piter's addiction is marked by a physical characteristic common to Arrakis—the blue eyes—his entire eye surface having become impregnated by transparent blue pigment. The spice wealth of ten billion solaris every three hundred thirty standard days is the bait in their Arrakis trap.



DUNE WORLD

Conclusion.
To establish a defensive system,
in a savagely competitive feudalism,
when you've been maneuvered out of your
well-secured home base
requires more than ability. It demands genius!
And the application of wild talents...

FRANK HERBERT

Illustrated by John Schoenherr

Part of the plot against the Duke Leto involves turning suspicion against the Lady Jessica, and part requires use of the Emperor's dread soldier-fanatics, the Sardaukar.

Having moved to Arrakis on a ship of the Guild which controls space travel and interplanetary banking, the Lady Jessica finds evidence that the Missionaria Protectiva *of her Order has planted legends among the Fremen. These are religious legends to protect any Bene Gesserits trapped on the planet. Confronting her new housekeeper, a Fremen woman called the Shadout—"Well Dipper"—Mapes, Jessica lives up to the* Missionaria Protectiva's *"prophecies."*

In Arrakeen Castle, Jessica finds a warning message left by the Bene Gesserit wife of Count Fenring, the Emperor's former representative on Arrakis. It hints at a "traitor lieutenant" and a threat to Paul. Paul overcomes the threat—a hunter-seeker assassination weapon—by his superior training, but the traitor suspicion is turned against the Lady Jessica. Idaho is brought back from a mission to the Fremen and ordered to keep secret watch on her.

Meanwhile, Jessica hopes to cement relations with the Houses Minor of Arrakis and holds a first dinner party for their leaders, inviting Dr. Kynes, the Emperor's planetologist and a mysterious power among the Fremen. She also invites a smuggler named Tuek, planning to bribe him to get her family off Arrakis in case of disaster. Kynes has just returned from guiding the Duke, Paul and Halleck on an inspection of spice mining where they saw a spice-factory crawler lost to a sandworm, but rescued the crew. Halleck is providing background music for the dinner on his baliset*—and keeping guard.*

Part 3

Jessica lowered her gaze, glanced at the people seated nearest her—there was the round-faced water-shipper and his woman, the austere Guild Bank representative—a whistle-faced scarecrow with eyes fixed on Leto; the smuggler, Tuek, his blue-within-blue eyes veiled.

"Review, friends—troops long past review," the Duke intoned. "All to fate a weight of pains and dollars. Their spirits wear our silver collars. Review, friends—troops long past review. Each a dot of time without pretense or guile—with them passes the lure of fortune. And when our time ends on its rictus smile, we will pass beyond the lure of fortune. Review, friends—troops long past review."

The Duke allowed his voice to trail off on the last line, took a deep drink from his water flagon, slammed it back on the table. Water slopped over the brim onto the linen.

The others sipped in embarrassed silence.

The Duke took up his water flagon, emptied its remaining half onto the floor, knowing the others around the table must now do likewise.

Jessica was the first to follow his example.

There was a frozen moment before the others began to empty their flagons.

Jessica watched her guests, fascinated by what their actions revealed, especially some of the women. This was clean, potable water—and the reluctance to just cast it away revealed itself in trembling hands, delayed reactions, violent obedience to the necessity. One woman dropped her flagon.

It was Kynes, though, who caught her attention most sharply. The planetologist hesitated only briefly, then emptied his flagon into a container beneath his jacket. He smiled at Jessica as he caught her watching him, raised the empty flagon toward her in a silent toast. He appeared completely unembarrassed by his action.

Gurney Halleck's music still wafted over the room, but it had come out of its minor key, lilting and lively now as though he were trying to lift the mood.

"Let us eat," the Duke said. He sank into his chair.

He's angry and uncertain, Jessica thought. *The loss of that factory crawler hit him deeply. But it must be more than that. He acts like a desperate man.* And she thought bitterly: *Why not? He is desperate.*

Slowly at first, then with increasing animation, the dinner began. The stillsuit manufacturer complimented Jessica on her chef and the wine.

"Superb!" he said, tasting the chukka. "Simply superb! And not even a hint of melange in it."

The Guild Bank representative looked across at Kynes. "I understand, Dr. Kynes, that another factory crawler has been lost to a worm."

"News travels fast on Arrakis," the Duke said.

"Then it's true?" the banker asked, shifting his attention to Leto.

"Of course it's true!" the Duke snapped. "The blasted carryall disappeared. It shouldn't be possible for anything that big to disappear!"

"And when the worm came there was nothing to lift off the crawler," Kynes said.

"It should not be possible," the Duke repeated.

"No one saw the carryall leave?" the banker asked.

"It is customary for those overhead to keep their eyes on the sand," Kynes said. "They look downward, you see, searching for wormsign. Each man has his assigned task. A carryall's complement usually is four men—two pilots and two journeymen attachers. If one—or even two of this crew were in the pay of one of the Duke's foes—"

"Ahhhh, I see." The banker nodded, returned his attention to his food.

And Jessica was remembering a lecture from her Bene Gesserit schooldays. The subject had been espionage and counter espionage. A plump, happy faced Reverend Mother had been the lecturer, her jolly voice contrasting weirdly with her subject matter.

"The thing to note about any espionage and/or counter espionage school is that all the graduates will have a similar basic reaction pattern conditioned by that school. This is true, of course, with the teaching of any enclosed discipline. It sets its stamp, its pattern upon the students. That pattern is susceptible to analysis and prediction. Which is what you actually will be learning in this course —analysis and prediction.

"Now, motivational patterns are going to be similar among all espionage agents generally. That is to say, there will be certain types of motivation which are similar despite differing schools or opposed aims. We will be studying how to separate this element in our analyses —first, through interrogation patterns which betray the inner orientation of the interrogators; second, by closely observing language/thought orientation of those we analyze. You will find it fairly simple to determine the root languages of your subjects—both through voice inflection and speaking pattern."

Now, sitting at table with her Duke and their guests, hearing the Guild Bank representative, Jessica realized the man was a Harkonnen agent. He had the Giedi Prime voice inflection and speech pattern—subtly marked, true, but plainly exposed to her trained senses. And she asked herself: *Does this mean the Guild itself has taken sides against the House of Atreides?*

This thought shocked her, and she masked her emotions, listening for the man to betray more of himself. *He will shift the conversation next to something seemingly innocent, but with ominous overtones,* she thought.

The banker swallowed, took a sip of wine, smiled at something said to him by the woman on his right. A man at the opposite end of the table was explaining to the Duke about the native plants having no thorns.

"I enjoy watching the flights of birds on Arrakis," the banker said, directing his words at Jessica. "Did you know that some of our birds exist without water, having become blood drinkers?"

The stillsuit manufacturer's daughter, seated between Paul and his father at the other end of the table, twisted her pretty face into a frown. "Oh, Soo-Soo, you say the most disgusting things," she said.

The banker smiled. "They call me Soo-Soo because of my unofficial position as financial adviser to the Water Peddlers' Union." And, as Jessica continued to look at him, he added: "Because of the water sellers' cry—'Soo-Soo Souk!' " And he imitated it with such accuracy that many around the table laughed.

Jessica heard the boastful quality in his voice, but she noted most that the young woman had spoken on cue—a set piece. She had produced the excuse for the banker to say what he had said. She glanced at Lingar Bewt, the water magnate. He was scowling, concentrating on his dinner. It became clear to Jessica what the banker had said. *"I, too, control water, the ultimate source of power on Arrakis."*

Paul, too, had heard the falseness in his dinner companion's voice, but the greater depths of the interplay were hidden from him. He saw, though, that his mother was getting something out of this conversation.

"Do you mean, sir," he asked, "that these birds are cannibals?"

"Not at all," the banker said. He stared at Paul. "That was an odd question, Young Master."

"It wasn't odd," Paul said, and Jessica noted that his voice carried the brittle riposte quality being trained into it. "Most people know that the worst potential competition for any young organism can come from its own kind." He deliberately forked a bite of food from his companion's plate, ate it. "They are eating from the same bowl and have the same basic requirements."

The banker stiffened under the lash of Paul's voice, scowled at the Duke who was smiling broadly.

"Do not make the error of considering my son a child," the Duke said.

Jessica glanced around the table, noted that Lingar Bewt had brightened. Both Kynes and the smuggler, Tuek, were smiling at Paul.

"It is a rule of ecology," Kynes said, "that the struggle between life forms is the struggle for the free energy of a system. Blood is an efficient source of energy."

The banker put down his fork, spoke in an angry voice: "It is said that the Fremen scum in the desert drink the blood of the dead."

Kynes shook his head, spoke in a casual, lecturing tone: "Not the blood, sir. But a man's water—all of it—belongs ultimately to his people, to his tribe. It is a necessity when you live in the Great Flat. All water is precious there, and the human body is composed of about seventy per cent water by weight. A dead man no longer requires this water."

The banker put both hands against the table beside his plate, and Jessica thought for a moment he was going to push himself back, leave the table in rage.

Kynes looked at Jessica. "Forgive me, My Lady, for elaborating on such an ugly subject at table, but you were being told a falsehood that needed clarifying."

"You have associated so much with Fremen that you've lost many sensibilities," the banker said.

Kynes looked at the banker, studied the pale, trembling face. "Are you challenging me, sir?" he asked.

The banker froze. He swallowed, spoke stiffly: "Of course not. I would not so insult our host and hostess."

Jessica heard the fear in the man's voice, saw it in his face, in his breathing, in the pulse of a vein at his temple. He was terrified of Kynes!

"Our host and hostess are quite capable of deciding for themselves when they have been insulted," Kynes said. "They are brave people who understand defense of honor. Attest their courage by the fact that they are here, on Arrakis."

Jessica saw that Leto was enjoying this. Most of the others were not. People all around the table sat poised for flight, hands in laps. Two notable exceptions were Bewt, who was openly smiling at the banker's discomfiture, and the smuggler, who appeared to be watching Kynes for a cue. Jessica saw that Paul was looking at Kynes in open admiration.

"Well?" Kynes said.

"I meant no offense," the banker muttered. "If offense was taken, I apologize."

Kynes nodded, resumed eating as though nothing had happened.

Jessica saw that the smuggler, too, relaxed. She marked this down in her mind. The man had shown every aspect of an aide ready to leap to Kynes' assistance. There was an accord of some sort between Kynes and Tuek.

The Duke looked speculatively at Kynes. There was that in the ecologist's manner which indicated a change in attitude toward the House of Atreides. He had seemed colder on their trip over the desert.

Jessica signaled for another course of food and drink to be brought to the table. Servants appeared with *langues de lapins de garenne,* red wine and a sauce of mushroom-yeast.

Slowly, the dinner conversation resumed, but Jessica noted that it appeared more brittle, and the banker ate in sullen silence.

"I find myself continually amazed by the importance of water on Arrakis," Jessica said to the stillsuit manufacturer on her left. And she noted that no more than half the women at the table shifted direction of conversation with her—indicating a difference of custom here, although they apparently knew the custom of Caladan.

"Very important," the stillsuit manufacturer agreed. "What is this dish? It's delicious."

"Tongues of wild rabbit in a special sauce," Jessica said. "It's a very old recipe."

"I must have that recipe," the man said.

She nodded. "I'll see that you get it."

Kynes looked at Jessica, said: "The newcomer to Arrakis too frequently underestimates the position of importance that water holds here. You see, you are dealing with the Law of the Minimum."

Jessica nodded, noting the *testing* quality in Kynes' voice. *He wishes to discover if I know the Law of the Minimum,* she thought.

"I see," she said. "Growth is limited by that necessity which is present in least amount. And where a number of conditions are necessary to a process, its rate is controlled by the least favorable of these conditions."

Kynes smiled. "Water is the least favorable condition for most life on Arrakis. And you must always keep in mind that *growth* itself can produce unfavorable conditions unless it is treated with extreme care."

"Are you speaking of population pressures?" Jessica asked.

"In part," Kynes said. "The aim should be to set up an orderly natural cycle of water that will sustain life as humans wish it to be sustained."

Lingar Bewt, the water magnate, joined the conversation. "Impossible to do on Arrakis," he barked. "Been plenty of laboratory confirmation of it."

Kynes shifted his attention to Bewt, and Jessica noted that other conversations around the table had stopped while the people watched and listened. When Kynes spoke, they listened. Her estimate of the planetologist's importance was being revised rapidly.

"Laboratory analysis tends to blind us to a very simple fact," Kynes said. "That fact is that we are dealing here with matters which have their origin and setting in the out-of-doors where plants and animals carry on their normal existence."

"Normal!" Bewt snorted. "Nothing about Arrakis is normal!"

"Quite the contrary," Kynes said. "You merely have to understand the limits of the planet and the pressures upon it. Certain harmonies could be set up here along self-sustaining lines."

"It'll never be done," Bewt said.

Kynes turned back to his dinner, smiling.

He knows something the others don't, Jessica thought.

The Duke, too, came to a sudden realization. He had placed the point where Kynes' attitude had changed—when Jessica had spoken of holding the plants of their conservatory in trust for Arrakis.

"What would it take to set up the self-sustaining system, Dr. Kynes?" Jessica asked.

"If we can get only three per cent of the green plant element on Arrakis involved in the process of forming carbon compounds as foodstuffs, we have started the cyclic system."

"Water is the only problem?" Jessica asked the planetologist.

"It overshadows the other problems," Kynes said. "But this planet has much oxygen without its usual concommitants—widespread plant life and large sources of free carbon dioxide. This tells us there are unusual chemical interchanges over large surface areas."

"Do you have pilot projects going?" she asked.

"On Arrakis," he said, "we have had a long period of time in which to build up the Tansley Effect—that is, small unit experiments on an amateur basis from which applied science, my science, may now draw its working facts."

"There isn't enough water," Bewt said. "There just isn't enough water."

"Master Bewt is an expert on water," Kynes said.

The Duke gestured down with his right hand, said: "No! I wish to hear more of this, Dr. Kynes. Is there enough water?"

Kynes stared at his plate.

Jessica watched the play of emotion in subtle movements on his face. He masked himself well, she thought, but she had him *registered* now, and could read him. He was regretting his words.

"Is there?" the Duke demanded.

"There . . . may be," Kynes said.

He's faking uncertainty! Jessica thought. But she failed to catch the direction of the man's concealment.

Paul, with his deeper truthsense, caught the underlying motive, and had to use every ounce of his training to mask his excitement. *There is enough water! But he doesn't wish this to be known!*

"Our Planetologist has many interesting theories," Bewt said. "He thinks the Fremen are interesting, too."

Chuckles sounded at odd places around the table. Jessica marked them—the smuggler, the stillsuit manufacturer's daughter, Duncan Idaho, the woman with the mysterious escort service . . . Jessica put a mnemonic marker beside the woman's name, Jenuay, for further investigation.

The tensions are oddly distributed here tonight, Jessica thought. *There's too much going on of which I'm not aware. I'll have to develop new information sources.*

"*May* be," the Duke muttered.

Kynes spoke quickly: "The real problem, My Lord, is the delicacy of the chemical balance between atmosphere and life. There is no ecological fact of greater importance. The low stage of carbon dioxide in the . . ."

The planetologist broke off as a uniformed trooper hurried in through the service door, was passed by the guard and rushed to the Duke's side. The man bent over, whispering in Leto's ear.

Jessica recognized the capsign of Hawat's corps on the man, fought down her uneasiness. She addressed herself to the stillsuit manufacturer's feminine companion—a tiny, dark-haired woman with a doll face, a touch of epicanthic fold to the eyes.

"You've hardly touched your dinner, my dear," Jessica said. "May I order something special for you?"

The woman looked at the stillsuit manufacturer before speaking, said: "I'm not very hungry."

Abruptly, the Duke stood up beside his trooper, spoke in a harsh tone of command: "Stay seated everyone, please. You will have to forgive me, but a matter has arisen which requires my personal attention." He stepped aside. "Paul, will you take over as host for me?"

Paul swallowed, wanting to ask why his father had to leave, knowing he could not ask. He stood up, moving around to his father's chair.

The Duke turned to the alcove where Gurney Halleck sat, said: "Gurney, please take Paul's place at table. We mustn't have an odd number here. When the dinner is over, bring Paul to the field CP."

Halleck emerged from the alcove in dress uniform, carrying his *baliset* at the trail. He leaned the instrument against the wall, crossed to the chair Paul had occupied and sat down.

"There is no need for alarm," the Duke said, "but I must ask that no one leave until our house guard says it is safe. You will be perfectly secure as long as you remain here, and we'll have this trouble cleaned up very shortly."

Paul caught the code words in his father's message—*guard, safe, secure, shortly*. The problem was security, not violence. He saw that his mother had heard the same message and relaxed.

The Duke turned, strode out through the service door.

Paul said: "Please go on with the dinner. I believe Dr. Kynes was talking about the atmosphere."

"It's really a very dull and complicated subject," Kynes said. "May I discuss it with you another time?"

"By all means," Paul said.

And Jessica noted how well her son wore his position—the dignity, the mature sense of assurance.

The banker picked up his water flagon, gestured with it toward the water magnate. "None of us here can surpass Master Lingar Bewt in flowery phrases. Come, Master Bewt, lead us in a toast to our new host, the boy who must be treated as a man."

Jessica clenched her right hand into a fist beneath the table.

Bewt cast a venomous glare at the banker.

Paul smiled, glanced once at Halleck, then at the banker, said: "Once, on Caladan, I saw the recovery of a drowned fisherman's body. He . . ."

"Drowned?" It was the stillsuit manufacturer's daughter.

Paul hesitated, then: "Yes. Immersed in water where he could not breathe and until he died. Drowned."

"What an interesting way to die," she said.

Paul's smile became brittle. He returned his attention to the banker. "The interesting thing about this man was that his shoulders and neck were wounded by another fisherman's clawboots. There apparently were several fishermen in a boat—a craft for traveling over the water—when the boat foundered and sank beneath the water. Another fisherman who was helping recover this body said he had seen such marks several times. They meant that one of the drowning fishermen had tried to stand on this poor fellow's shoulders in the attempt to reach up to the surface of the water—to reach the air."

"Why is this interesting?" the banker asked.

"It is interesting because of an observation made by my father at the time. He said that the drowning man who climbs on your shoulders to save himself is understandable . . . except when you see it happen in the drawing room." Paul hesitated, then: "And I might add—except when you see it happen at the dinner table."

A sudden, deathly stillness enfolded the room.

That was rash of him, Jessica thought. She glanced at Idaho, halfway down the table on her right, saw that he was poised for instant action. The house troopers in servant livery were alert. And she comforted herself with the thought that Gurney Halleck remained with them, although he seemed so relaxed and casual where he sat near Paul.

"Hoh-ho!" It was the smuggler, Tuek, head thrown back, laughing.

Bewt grinned at the banker, who was directing a black glare at Paul.

"Is it the Atreides custom to insult their guests?" the banker demanded.

Before Paul could answer, Jessica leaned forward, said: "Sir!" And she thought: *We must have more information about this Harkonnen creature.*

"My son displays a general garment and you claim that it's cut to your fit?" Jessica asked. "What an interesting revelation."

The banker turned his glare on Jessica.

Kynes directed a speculative look at Jessica, gave a subtle hand signal to Tuek.

The smuggler lurched to his feet, lifted his flagon. "I'll give you a toast," he said. "To young Paul Atreides, still a lad by his looks, but a man by his actions!"

Why do they intrude? Jessica asked herself.

The banker was staring now at Kynes, and Jessica saw terror return to the Guild agent's face.

People were responding to the toast all around the table. Jessica lifted her flagon to Kynes, who responded in kind.

Only Paul and the banker—*Soo-Soo! What an idiotic nickname!* Jessica thought—remained empty handed. The banker's attention remained on Kynes. Paul was staring at his plate.

Gurney Halleck stirred, spoke as though to no one in particular, directing his words over the heads of the people across from him: "In our society, people should not be quick to take offense. It's frequently suicidal." He turned, looked at the stillsuit manufacturer's daughter beside him. "Don't you think so, miss?"

"Oh, yes. Yes. Indeed I do," she said. "There's too much violence. It makes me sick. And lots of times no offense is meant, but people get hurt anyway. It doesn't make sense."

"Indeed it doesn't," Halleck said.

The banker turned a sickly grin toward Jessica, said: "My Lady, I fear I've overindulged in your wines. You serve potent drink at table, and I'm not accustomed to it."

Jessica heard the venom beneath his tone, spoke sweetly: "When strangers meet, great allowance should be made for differences of custom and training."

"Thank you, My Lady," he said.

The dark-haired woman beside the stillsuit manufacturer leaned toward Jessica. "The Duke spoke of our being secure here. I hope that doesn't mean there's more fighting.

She was directed to lead the conversation this way, Jessica thought.

"Every rumor has to be checked out," Jessica said. "Likely this will prove unimportant. But as long as there's

bad blood between Atreides and Harkonnen we cannot be too careful. The Duke has sworn to leave no Harkonnen agent alive on Arrakis, and, of course, the Convention supports him in this."

The woman nodded, sat back.

Jessica turned, smiled at the banker, said: "You spoke earlier of birds and their habits. I find so many things interesting about Arrakis. Please, tell me more from your intimate experience with this strange place."

"Tell her about the thumpers," Bewt called.

"Thumpers?" Jessica asked. "What are thumpers?"

"It has something to do with the Fremen religious practices," the banker said.

Out of the corners of her eyes, Jessica saw Kynes rubbing at his upper lip. It was a curious gesture to her with the hand standing out so sharply against the beard.

"But what *is* a thumper?" Jessica asked.

"A . . . a device," the banker said. "They're found in the sand occasionally. Designs and materials differ, but they all appear to have the same purpose, to create a thumping sound within the sand. A typical one would have a stick about a meter in length to be pushed into the sand. At the upper end would be an elastic cord and ratchet mechanism driving a flail to *thump* against the stick."

"A prayer wheel of some kind?" Jessica asked.

Then she recalled that drumming sounds within the sand were supposed to attract the giant worms.

"Something like that, I suppose," the banker said.

"Are they found in many parts of the desert?"

"I'm not familiar with all the finds, My Lady."

Jessica looked at Kynes. "Perhaps our planetologist could tell us."

Kynes cleared his throat, glanced at Tuek, back to Jessica. "Such finds are rare, My Lady. But it is said that most such finds are near the Shield Wall."

"And none in the empty southern regions?"

"Very little is known of those areas," Kynes said. "It is said there's a great Mother Lode of spice to be found there, and, occasionally, some daring spice hunter penetrates somewhat into the region, but it is extremely dangerous. Casualties increase very dramatically the farther you operate from a fixed base. It has not been found profitable to venture too far into those regions. The storm watch doesn't cover that area, you know. Perhaps if we had a weather satellite . . ."

"There's no water at all there?" Jessica asked.

The banker said: "It is said the Fremen travel anywhere, that they've hunted out soaks and sip-wells even into the deepest southern latitudes."

"Soaks and sip-wells?" Jessica asked.

Kynes spoke quickly: "Wild rumors, My Lady. A soak is supposedly a place where water seeps up from the planet's interior and may be found by digging according to certain signs. A sip-well is a form of soak. It is said that a person may take a straw and slowly draw water from such a soak, sucking it up and expelling it into a container. The system is known on other planets."

He's lying, Jessica thought. *Falsehood and concealment all through what he's been telling us.* She glanced at Paul, saw that he, too, was aware of Kynes' deception.

"How very interesting," Jessica said. And she thought: *What a curious speech mannerism they have here. If they only knew how much it tells me!*

Paul thought: *He lies about water. He lies about the purpose of the thumper. I must discuss this man's lies with my mother.*

"My teacher, Dr. Yueh, says you have a saying on Arrakis," Paul said, "that polish comes from the cities; wisdom comes from the desert."

"Oh, there are many sayings on Arrakis," Kynes said.

"How about the saying: 'Don't build on land that can be irrigated'?" Bewt asked.

Kynes frowned at the man. "It is said," he said, "that the streets in the poorer quarters of Arrakis are full of refuse, but all of it is dry refuse."

Before Jessica could try to penetrate this interchange, a servant bent over her with a note. She opened it, saw the Duke's handwriting, scanned it.

"You'll all be delighted to know," she said, "that our Duke sends his reassurances. The matter which called him away has ben solved. The missing carryall has been found. A Harkonnen agent in the crew overpowered the others and flew the machine to a smugglers' base, hoping to sell it to them. Both the man and the machine are now in Atreides hands."

"How fortunate for you," the banker said.

Jessica nodded, refolded the note, tucked it into her sleeve.

"I'm glad it didn't come to open battle," the stillsuit manufacturer said. "The people have such hopes that the Atreides will bring peace and prosperity."

"Especially prosperity," Bewt said.

"Shall we have our dessert now?" Jessica asked. "I've had our chef prepare a Caladanian sweet—*pongi rice in sauce dolsa.*"

"It sounds wonderful," the stillsuit manufacturer said. "Would it be possible to get the recipe?"

"Any recipe you desire," Jessica said. She stared down the table, thinking of the coded part of the message which she had not recounted: *"The Harkonnens tried to get in a shipment of lasguns. We captured them. This may mean, though, that they've succeeded with other shipments. It certainly means they do not place much store in our shields. Take the appropriate precautions."*

Jessica thought of lasguns—the white hot beams of disruptive light that could get through any known substance, provided that substance was not shielded. The fact that feedback from a shield would explode a lasgun did not bother the Harkonnens? She wondered why.

Paul said: "I never doubted we'd find that carryall. Once my father moves to solve a problem, he solves it. He is a great man, my father, as the Harkonnens are beginning to discover."

He's boasting, Jessica thought. *He shouldn't boast. No person who will be sleeping below the ground level this night as a protection against lasguns has the right to boast.*

XVII

"There is no escape—we pay for the violence of our ancestors."

"The Collected Sayings of Muad'Dib"
by The Princess Irulan

Jessica heard the disturbance in the great hall, turned on the light beside her bed. The clock there had not been properly adjusted to local time, and she had to subtract twenty-one minutes to realize it must be about two o'clock.

The disturbance was loud and incoherent.

Is this the Harkonnen attack that will destroy us? she asked herself.

She slipped out of bed, checked the screen monitors to see where her family was. The screen showed Paul asleep in the cellar room they had hastily converted to a bedroom for him. The noise obviously wasn't penetrating to his quarters. There was no one in the Duke's room, the bed unrumpled. He was still at the CP probably.

There were no screens yet to the front of the house.

Jessica stood in the middle of her room, listening.

There was one shouting, incoherent voice. She heard someone call for Dr. Yueh. Jessica found a robe, pulled it over her shoulders, pushed her feet into slippers.

Again, a voice called for Dr. Yueh.

Jessica belted the robe around her, stepped into the hallway. Then the thought struck her: *What if Leto's been hurt?*

The hall seemed to stretch out forever under her running feet. She turned through the angled arch at the end, dashed through the dining hall and down the passage into the great hall.

The place was brightly lighted, all the wall suspensors glowing at maximum. To her right, near the front entry, she saw two house guards holding Duncan Idaho between them. His head lolled forward, and there was a panting silence to the scene now.

One of the house guards spoke accusingly to Idaho: "You see what you did? You woke the Lady Jessica."

The great draperies billowed behind the men, showing that the front door remained open. There was no sign of the Duke or Dr. Yueh. Mapes stood to one side staring coldly at Idaho. She wore a long brown robe with serpentine design at the hem. Her feet were pushed into desert boots.

"So I woke the Lady Jessica," Idaho muttered. He lifted his face toward the ceiling, bellowed: "My sword was firs' bloodied on Grumman!"

And Jessica thought: *Great Mother! He's drunk!*

The dark round face was drawn into a frown. His hair, curling like the fur of a black goat, was plastered with dirt. A jagged rent in his tunic exposed an expanse of the dress shirt he had worn at the dinner party earlier.

Jessica crossed to him.

One of the guards nodded to her without releasing his hold on Idaho. "We didn't know what to do with him, My Lady. He was creating a disturbance out front, refusing to come inside. We were afraid some locals might come along and see him. That wouldn't do at all. Give us a bad name here."

"Where has he been?" Jessica asked.

"He escorted one of the young ladies home from the dinner, My Lady. Duke's orders."

"Which young lady?"

"One of the escort wenches who came with that Madame Jenuay. You understand, My Lady." He glanced at Mapes, lowered his voice. "They're always calling on Idaho for special surveillance of the ladies."

And Jessica thought: *So they are.*

She frowned, turned to Mapes. "Mapes, bring a stimulant. Caffeine, I'd suggest. Perhaps there's some of the spice coffee left from dinner."

Mapes shrugged, headed toward the kitchen. Her untied desert boots slap-slapped against the floor.

Idaho swung his unsteady head around to peer at an angle toward Jessica. "Killed more'n three hunner' men f'r th' Duke," he muttered. "Wadduh wanna know is why'm here. Can't live unner th' groun' here. Can't live on th' groun' here. Wha' kinna place is 'iss, huh?"

A sound from the side hall entry caught Jessicas attention. She turned her head, saw Dr. Yueh crossing to them, his medical kit swinging in his left hand. He was fully dressed, looked pale, exhausted. The diamond tattoo of his school stood out sharply on his forehead.

"The' good docker!" Idaho shouted. "Whad're you, Doc? Splint 'n' pill man?" He turned blearily to Jessica. "Makin' uh damn' fool uh m'self, huh?"

Jessica frowned, remained silent. *Why should he do such a thing?* she wondered. *Was he drugged?*

"Had too much spice beer," Idaho said, attempting to straighten himself. "Wunnerful stuff."

Mapes returned with a steaming cup in her hands, stopped uncertainly behind the doctor. She looked at Jessica, who shook her head.

Dr. Yueh put his kit on the floor, said: "Spice beer?"

"Bes' damn' stuff ever tas'ed," Idaho said. He tried to pull himself to attention. "My sword was firs' blooded on Grumman! Killed a Harkon . . . Harkon . . . killed 'im f'r th' Duke."

Dr. Yueh turned, looked at Mapes, at the cup in her hand. "What's that?"

"Caffeine, doctor," Jessica said.

Dr. Yueh nodded, took the cup, turned and held it toward Idaho. "Drink this, lad."

"Don' need any more drink."

"Drink it, I say!"

Idaho's head wobbled toward the doctor, and he stumbled ahead one step, dragging the house guards with him. "I'm almighdy fed up with pleasin' th' 'Mperial Universe, Doc. Jus' once . . . just once . . . we're gonna do th' thing my way."

"After you drink this," Dr. Yueh said. "It's just caffeine."

"How'd I know? 'Sprolly like alla res' uh this place. Damn' sun 'stoo brighd. Nothin' has uh righd color. Ever'thing's gray or brown or . . ."

"Well it's nighttime now," Dr. Yueh said. He spoke reasonably. "Drink this, lad. It'll make you feel better."

"Don' wanna feel bedder!"

"We can't argue with him all night," Jessica said. And she thought: *This calls for a bit of shock.*

"There's no reason for you to stay, My Lady," Dr. Yueh said. "I can take care of this."

Jessica shook her head. She stepped forward, slapped Idaho sharply across the cheek.

He stumbled back with his guards, glaring at her.

"This is no way to act in your Duke's home," she said. She snatched the cup from Dr. Yueh's hands, spilling part of it, thrust the cup toward Idaho. "Now, you drink this! That's an order!"

Idaho jerked himself upright, scowling at her. He spoke slowly, with careful and precise enunciation: "I do not have to take orders from a damn' Harkonnen spy!"

Dr. Yueh stiffened, whirled to face Jessica.

Her face had gone pale, but she was nodding. Something had become clear to her—all the broken stems of meaning she had seen in the Duke's words and actions these past few days now could be translated. She found herself in the grip of an anger almost too great to contain. It took the deepest of her Bene Gesserit training in calmness to quiet her pulse and smooth her breathing. And even then she could feel the blaze flickering.

They were always calling on Idaho for special surveillance of the ladies!

She shot a glance at Dr. Yueh. The doctor lowered his eyes.

"You knew this?" she demanded.

"I heard . . . rumors, My Lady. I saw . . . I suspected. But I didn't want to add to your burdens."

"Hawat!" she snapped. "I want Thufir Hawat brought here immediately!"

"But, My Lady . . . "

"Immediately!"

It has to be Hawat, she thought. *A suspicion such as this could come from no other source.*

Idaho shook his head, mumbled: "Chuck th' whole damn' thing. 'Sno damn' good."

Jessica looked down at the cup in her hand, abruptly dashed its contents across Idaho's face. "Lock him in one of the guest rooms in the east wing," she ordered. "Let him *sleep* it off."

The two guards stared at her unhappily. One ventured: "Perhaps we should take him some place else, M'Lady. We could . . ."

"He's supposed to be here!" Jessica snapped. "He has a job to do here, you know." Her voice dripped bitterness. "He's so good at watching the ladies, isn't he?"

The guard swallowed.

"Do you know where the Duke is?" Jessica asked.

"He's at the Command Post, My Lady. At the landing field."

"Is Hawat with him?"

"Hawat is in the city, My Lady."

"You will bring Hawat to me immediately," Jessica said. "I will be in my sitting room when he arrives."

"But, My Lady . . ."

"If necessary, I will call the Duke," she said.

"Yes, My Lady."

Jessica thrust the empty cup into Mapes' hands, met the questioning stare of the blue-within-blue eyes. "You may go back to bed, Mapes."

"You're sure you will not need me?"

Jessica smiled grimly. "I'm sure."

"Perhaps this could wait until tomorrow," Dr. Yueh said. "I could give you a sedative and . . ."

"You will return to your quarters and leave me to handle this my way," she said. She patted his arm to take the sting out of her command. "This is the only way."

Abruptly, head high, she turned and stalked off through the house to her rooms. She slammed the door behind her, stood there glaring at the shield-blanked windows. *Hawat! Is he the one the Harkonnens bought?*

Jessica crossed to her deep old-fashioned armchair, moved it into position to command the door. She was suddenly very conscious of the cryskniſe in its sheath secreted beneath her pillow, went into the bedroom and returned with it strapped to her arm. She glanced around the room, taking in the chaise, the reel and bookcases, the low tables, the straight chairs, her stand-mounted zither. Pale rose light came from the suspensor lamps. She dimmed them, sat down in the armchair, appreciating its regal heaviness for this occasion.

We shall see, she thought. And she prepared herself to wait, accumulating patience, saving her strength.

Presently, Hawat came in the door across from her. He moved with a stiff sense of drug-induced energy, and she could see the fatigue beneath it. The rheumy old eyes glittered. His leathery skin appeared faintly yellow in the room's light, and there was a wide wet stain on the sleeve of his knife arm.

Jessica gestured to a straight backed chair against the wall. "Bring that chair and sit here facing me."

Hawat bowed, obeyed. *That drunken fool of an Idaho!* he thought. He studied Jessica's face, wondering how he could save this situation.

"It's long past time to clear the air between us," Jessica said.

"What troubles My Lady?"

"Don't play coy with me!" she snapped. "If Dr. Yueh didn't tell you why I summoned you, then one of your spies in my household did. Shall we be at least that honest with each other?"

"As you wish, My Lady."

"First, you will answer me one question," she said. "Are you now a Harkonnen agent?"

Hawat's face darkened. He surged half out of his chair, demanding: "You dare insult me so?"

"Did you not insult me this way?" she asked. "Sit down."

Slowly, he sank back into the chair.

And Jessica, reading the signs on this face she knew so well, allowed herself a deep breath of relief. *It isn't Hawat,* she thought.

"Now, I know you remain loyal to my Duke," she said. "Therefore I'm prepared to forgive your affront to me."

"Is there something to forgive?" he asked.

Jessica scowled, wondering, *Shall I play my trump? Shall I tell him of the Duke's daughter I've carried within me these two weeks? No, Leto himself doesn't know and this would only complicate his life, divert him when he must concentrate on our survival. There is yet time to use this.*

And Hawat thought: *She's even beautiful when she's angry. An extremely dangerous adversary.*

"Since learning that there could be a traitor among us," Jessica said, "I've been studying our people with care. Let us re-examine the possibilities. Who could be a Harkonnen agent? It's not Gurney. It's certainly not Duncan Idaho. It's not any of their immediate lieutenants. It's not you, Thufir. It cannot be Paul. Great Mother! I know it's not me. Dr. Yueh, then? Even without consideration for his conditioning, I know about his wife. She was Bene Gesserit, Thufir, and was slain by the Harkonnens."

"So that's what happened to her," Hawat muttered. "How'd you find out?"

"An inadvertent revelation, Thufir. Haven't you ever noticed the hate in his voice when he speaks of the Harkonnens?"

"I do not have the ear," Hawat said.

"Then where do we look?" she asked. "Among the household guard?"

"I swear by them on my own honor," he said.

"It is to the Harkonnen advantage to sow dissension among us," she said. "I do not have to tell you that."

Hawat frowned.

"What caused you to direct a baseless suspicion at me?" she asked.

Hawat's frown deepened. "My Lady puts her servant in an impossible position. My first loyalty is to the Duke."

"I am prepared to forgive much because of that loyalty," she said.

"And I must ask again: Is there something to forgive?"

"You imply there'd be nothing to forgive were your suspicions correct," she said.

"Should I reveal the source of my . . . ah, *curiosity*, would that not put another weapon into the hands of someone who *could* be an adversary?"

"Stalemate?" she asked.

He shrugged.

"Let us discuss something else then," she said. "Duncan Idaho, the admirable fighting man whose abilities at guarding and surveillance are so highly esteemed. Tonight, he overindulged in something called spice beer. I hear reports that many others among our people have been stupefied by this concoction. Is that true?"

"You have your reports, My Lady."

"So I do. Don't you see this drunkenness as a symptom, Thufir?"

"My Lady speaks riddles."

"Apply your Mentat training to it!" she snapped. "What is the problem with Duncan and the others? I can tell you in four words—they have no home."

He stared at her, pointing to the floor beneath them. "Arrakis, that's their . . ."

"Arrakis is an unknown! Caladan was their home and we've uprooted them. They have no home. And they fear the Duke is failing them."

He stiffened. "Such defeatist talk from one of the men would be cause for . . ."

"Is it defeatist for a doctor to diagnose a disease correctly, his intention being to cure the disease?"

"The Duke has given me charge over such matters, as did his father before him."

"But you will understand my natural concern over the progress of this disease," she said. And she thought: *I will have to shock him severely. He needs to be shaken up.*

Hawat shrugged. "There could be many interpretations for your . . . concern."

"How many of our people are aware of this suspicion you direct at me?" she demanded.

He studied her, then: "Unfortunately, it has leaked to . . . ah, several." And he thought: *In the hope it would reveal a channel in the Harkonnen machine leading back to you.*

"Then you've already convicted me?"

"Of course not, My Lady. But, the situation being what it is, I cannot afford to take *any* chances."

"A threat to my son got past you right here in this house," she said. "Who took that chance?"

His face darkened. "I offered my resignation to the Duke. He refused."

"Did you offer your resignation to me . . . or to Paul?"

Now, he was openly angry, betraying it in quickness of breathing, in dilation of his nostrils, the steady stare. She saw a pulse beating heavily at his temple.

"I am the Duke's man," he said, biting off the words.

"Would you destroy the Duke in your effort to save him?"

He took a deep breath, then: "If you are innocent, it is a sadness to have you placed in this position, but it cannot be helped."

"Look you now, Thufir," she said. "Humans live best when each has his own place, when each knows where he belongs in the scheme of things. Destroy the place and you destroy the person. This is frequently the case. You and I, Thufir, of all those who love the Duke, we are most ideally situated to destroy the other's place. Could I not whisper suspicions about you into the Duke's ear at night. When would he be most susceptible to such whispering, Thufir? Must I draw it for you more clearly?"

"You threaten me?" he asked, and his voice was low, withdrawn.

"Indeed not. I merely say to you that someone is attacking us through the basic arrangement of our lives. It is clever, diabolical. I propose to negate this attack by so ordering our lives that there will be no chink through which such barbs may enter."

"You accuse me of whispering baseless suspicions?" he asked.

"Baseless, yes."

"You would meet this with your own whispers?"

"No, Thufir. Your life is compounded of whispers, not mine."

"You question my abilities?"

She sighed. "Thufir, the *natural* human is an animal without logic. It's an *un*-natural development, this projection of logic onto all our affairs, and it's suffered to continue because of its supreme usefulness. You, now, you are the embodiment of logic—a Mentat. Yet, you must know, Thufir, that your solutions for problems are conceptions which, in a very real sense, are projected outside yourself—there to be rolled around, studied, examined from all sides."

"You think now to teach me my trade?" he asked, and he did not try to hide the disdain in his voice.

"When something goes wrong, you're extremely capable of seeing it and fixing it just as long as it's outside yourself," she said. "This is the natural human ability with logic. But when we encounter personal problems—that which is most deeply personal is the most difficult to bring out for external examination—we tend to flounder around, blaming everything but the actual, deep-seated matter really chewing on us."

"You are deliberately attempting to undermine my faith in my abilities as a Mentat," he said. "Were I to find one of our people attempting to sabotage any other weapon in our arsenal, I should not hesitate to denounce him and destroy him."

"The finest Mentats have a healthy respect for the error factor in their computations," she said.

"I've never said otherwise!"

"Then study these symptoms I parade before you: Drunkenness among the men. They're quarrelsome. They gossip and exchange weird rumors about Arrakis. What sickness . . ."

"Idleness, no more," he said. "The men must be kept alert and prepared for any violence, but this is a form of idleness. They prefer action. There were pleasant diversions on Caladan which are denied them here. We could make work, but they'd know what we were doing. You must remember we brought the cream of our forces only. Don't attempt to divert my attention by trying to make a simple matter appear mysterious."

She stared at him, thinking of the Duke's men rubbing their woes together in the barracks until you could all but smell the charge there—like burnt insulation. *They're becoming like the men of the pre-Guild legend,* she thought. *Like the men of the lost star-searcher, Ampoliros—sick at their guns—forever prepared and forever unready.*

"As you said," he murmured, "stalemate."

"Why have you never used my abilities in your service to the Duke?" she asked. "Do you fear a rival for *your* position?"

He glared at her, the old eyes blazing. "I know about some of the training they give you Bene Gesserit . . . " He broke off, frowning.

"Go ahead, say it," she said. "Bene Gesserit *witches.*"

"I know something of the *real* training they give you," he said. "I'm not fooled by the program they give out to the public."

He is almost ready to be shaken up, she thought.

"You listen respectfully to me in Council," she said, "yet you seldom heed my advice. Why?"

"You may think you can look through a man," he said. "You may *think* you can make a man do exactly what . . ."

"You poor fool, Thufir!" she snapped.

He scowled, pushing himself back in the chair.

"Whatever rumors you've heard," she said, "the truth is far greater. If I wished to destroy the Duke . . . or you, or any other person within my reach, you could not stop me . . . short of killing me. And you might even find that a problem you couldn't solve."

And she thought: *Why do I let pride drive such words out of me? This is not the way I was trained. And this is not how I must shock him.*

Hawat slipped a hand into his tunic pocket where he kept a tiny projector of poison darts. *She wears no shield,* he thought. *Is this an idle brag of hers? She could not have such ability. I could slay her now . . . but, ah, the consequences if I'm wrong.*

Jessica saw the gesture toward the pocket. "Let us pray that violence shall never be necessary between us," she said.

"A worthy prayer," he agreed.

"Meanwhile, the sickness spreads among our people," she said. "Thufir, I ask you again: Is it not more reasonable to suppose the Harkonnens have planted this suspicion to pit us against each other, you and I?"

"You know I've asked myself that question," he said.

"We appear to have returned to stalemate," she said.

"So it would seem."

He's almost ready, she thought.

"What's really our weakest link, Thufir?" she asked.

"My Lady?"

"The Duke and I are father and mother surrogates to our people," she said. "The . . ."

"He has not married you," Hawat said.

A good riposte, she thought.

"But he will not marry anyone else," she said. "Not as long as I live. And we are the surrogates, as I said. To break up this natural order in our affairs, which target offers itself most enticingly to the Harkonnens? The Duke? No one among us, with the possible exception of Paul, is better guarded. Me? I tempt them, surely. But there's a better target, one whose duties necessarily create a monstrous blind spot. One to whom suspicion is as natural as breathing. One who builds his entire life on innuendo and mystery." She darted out her hight hand, pointing at him. "You!"

Hawat started to leap up from his chair.

"I have not dismissed you, Thufir" she flared.

The old man almost fell back into the chair, so quickly did his muscles betray him.

She smiled without mirth.

"You know something of the *real* training they give us?" she asked.

He swallowed in a dry throat. Her command had been regal, peremptory—uttered in a tone and manner he had found completely irresistible. His body had obeyed before he could think about it. To do such a thing required a sensitive, intimate knowledge of the person thus commanded, a depth of control that he had not dreamed was possible.

"I have said to you before that we should understand each other," she said. "What I meant was that *you* must understand *me.* I already understand you. And I tell you that it's your loyalty to the Duke alone which guarantees your safety with me."

He wet his lips with his tongue, staring at her.

"If I desired a puppet, the Duke would marry me," she said. "He might even think he did it of his own free will."

Hawat lowered his head, looked upward at her through his sparse lashes. Only the habits of a lifetime kept him from calling out for the guard. The habits of a lifetime . . . and the suspicion now that this woman might not permit it. His skin crawled at the memory of how she had controlled him. In that moment of hesitation, she could have drawn a weapon and destroyed him!

Does every human have this blind spot? he wondered. *Can any among us be thus ordered into action before he can resist?* The idea staggered him. *The power that would give a person! Who could stop such a one?*

"You have glimpsed the fist within the Bene Gesserit glove," she said. "What I did was a simple thing for us. Think on that. You have not seen my entire arsenal."

"Why are you not out destroying the Duke's enemies?" he asked.

"What would you have me destroy?" she asked. "Would you have me make of our Duke a weakling, forever leaning on me?"

"But, with such power . . ."

"You think: *How easy it would be for her to shape a human tool to thrust into an enemy's vitals.* Even into your vitals, Thufir. Yet, what would such action accomplish? Would I not make all Bene Gesserits suspect? No, Thufir. We do not want such power in matters of state. We do not want it, nor can we have it. We would destroy ourselves in seeking it."

"Then what is it you want?"

"A universe in which humans may live."

The words hung between them.

There's hidden meaning in that statement, he thought.

"It's enough for now that you've glimpsed the fist," she said. "I know you Thufir."

"So it would seem," he admitted.

"You'll say nothing about this to anyone," she said. "But you'll think now what it means that your life hangs by the thread of your loyalty to *my* Duke."

"My Lady . . ." The old man tried to swallow.

And he thought: *She has power over me, yes. But would that not make of her an even more dangerous tool for the Harkonnens?*

"The Duke could be destroyed as quickly by his friends as by his enemies," she said. "I trust now you'll get to the bottom of this suspicion and remove it."

"If it prove baseless, you will have my humblest apologies," he said.

"*If,*" she sneered.

"If," he said.

"You are, indeed, tenacious," she said. "Then I'll give you another thing to consider. Apply yourself as a Mentat to this question."

"I always use *all* of my abilities, My Lady."

"It is to be hoped," she said. "I pose a question, then: What does it mean to you that you stand before another human, that you are bound and helpless and the other human holds a knife at your throat—yet this other human refrains from killing you, frees you from your bonds and hands you the knife?"

She lifted herself out of the chair, turned her back on him. "You may go now, Thufir."

The old man arose, hestitated, hand creeping toward the weapon in his tunic pocket. He was reminded of the bull ring, and of the Duke's father—who had been brave, no matter his other failings—and one day of the *corrida* long ago: The fierce black beast had stood there, head bowed, immobilized and confused. The old Duke had turned his back on the horns, cape thrown flamboyantly over one arm, while cheers rained from the stands.

I am the bull and she the matador, Hawat thought. He withdrew his hand from the weapon, glanced at the sweat glistening in his empty palm.

And he knew that whatever the facts proved to be in the end, he would never forget this moment nor lose this sense of supreme admiration for the Lady Jessica.

Quietly, he left the room.

Jessica lowered her gaze from the reflection in the windows, turned, smiling.

"Now we will see some proper action," she whispered.

XVIII

Do you wrestle with dreams?
Do you contend with shadows?
Do you move in a kind of sleep?
Time has slipped away.
Your life is stolen.
You tarried with trifles,
Victim of your folly.

Dirge for Jamis on the Funeral Plain,
from "Songs of Muad'Dib"
by The Princess Irulan

Leto stood in the foyer of his house, studying a note by the light of a single suspensor lamp. Dawn was yet a few hours away, and he felt his tiredness. A Fremen messenger had brought the note to the outer guard just now as the Duke arrived from his command post at the landing field.

The note read: "A column of smoke by day, a pillar of fire by night."

There was no signature.

What does it mean? he wondered.

The messenger had gone without waiting for an answer and before he could be questioned, slipping into the night like some smoky shadow.

Leto pushed the paper into his tunic pocket, thinking to show it to Hawat later. He brushed a lock of hair from his forehead, took a sighing breath. The anti-fatigue pills were beginning to wear thin again. It had been a long two days since the dinner party and longer than that since he had slept. The problem of the lasgun shipment and interrogating the traitor who'd stolen the carryall had eaten time. There'd been a full day of redistributing his forces on the basis of the latest intelligence. And this night

there'd been more reports from the planetary outposts to review and evaluate.

To top it, there'd been that disquieting session with Hawat, the report on Jessica's reaction.

Blast Duncan Idaho! Leto thought.

He shook his head. *No, not Duncan. I was wrong not to take Jessica into my confidence at the beginning. I must do it now, before more damage is done.*

The decision made him feel better, and he hurried from the foyer, through the great hall and down the passages toward the family wing.

At the turn where the passages split to the service area, he stopped. A strange mewling sound came from somewhere down the service passage. Leto put his left hand on the switch of his shield belt, slipped his kindjal into his right hand. The knife conveyed a sense of reassurance. The strange sound had sent a chill through him.

Softly, the Duke moved down the service passage, cursing at the inadequate illumination. The smallest of suspensors had been spaced about eight meters apart along here and turned to their dimmest level. The dark stone walls seemed to swallow the light.

A dull blob appeared out of the gloom stretched across the floor ahead.

Leto hesitated, almost activated his shield, but refrained because that would limit his movements. Silently, he moved up to the blob, saw that it was a human figure, a man, face down on the stone. Leto turned him over with a foot, bent close in the dim light to see the face. It was the smuggler, Tuek, a wet stain down his chest. The eyes stared with empty darkness. Leto touched the stain—warm.

How could this man be here and dead? Leto asked himself. *Who killed him?*

The mewling sound was louder here. It seemed to come from ahead and down the side passage to the room where they had installed the main shield generator for the house.

Hand on belt switch, kindjal poised ahead, the Duke skirted the body, slipped down the passage and peered around the corner toward the shield generator room. Another blob appeared on the floor only a few paces away, and it was the source of the noise. The shape crawled toward him, gasping, mumbling.

Leto stilled the sudden constriction of fear, darted down the passage, crouched beside the crawling figure. It was Mapes, the Fremen housekeeper, hair tumbled around her face, clothing disarrayed. A dull shininess of dark stain along her side. He touched her shoulder. She lifted herself on her elbows, tipped her head up to peer at him.

" 'Syou," she gasped. "He . . . killed . . . guard . . . sent me . . . get . . . Tuek . . . escape . . . for . . . M'Lady . . . Yueh . . . here . . . no . . . chance . . . to . . ." She flopped forward, her head thumping against the stone.

Leto felt for a pulse at the temples. There was none.

His mind raced. Who did she mean had killed the guard? And that smuggler, Tuek. Had Jessica sent for him to escape? Why?

He started to stand up. A sixth sense warned him, and he flashed a hand toward the shield belt switch, but was too late. A numbing shock slammed his arm aside. He felt pain there, saw a dart protruding from the sleeve, sensed paralysis spreading up the arm. It took an agonizing effort to lift his head and look down the passage. Dr. Yueh stood in the open door of the generator room. His face appeared to glow yellow in the light of a single, bright suspensor above the door. There was stillness from the room behind Yueh, no sound of generators.

Yueh! Leto thought. *He's sabotaged the house generators! We're wide open!*

Yueh began walking toward him, pocketing a dartgun.

Leto found that he could still speak, gasped: "Yueh! How?" Then the paralysis reached his legs and he slid to the floor, his back propped against the stone wall.

Yueh bent over him, a look of sadness on his face, touched Leto's forehead. Leto found that he could feel the touch, but it was remote, dull.

"Yes, I'm betraying you," Yueh said. He straightened. "The drug on the dart is selective. You can speak, but I'd advise against it." He glanced down the hall, bent again over Leto, pulled out the dart and tossed it aside. The sound of the dart clattering on the floor was faint and distant to the Duke.

Yueh! Leto thought. *It can't be. It's impossible. He's conditioned.*

"How?" Leto whispered.

"An override on my pyretic conscience," the doctor said. "I'm sorry, my dear Duke, but there *are* things which will make greater demands on even this conditioning." He touched the diamond tattoo on his forehead. "I find it very strange, myself, but I wish to kill a man. Yes, I actually wish it."

It took great effort, but the Duke managed to gasp: "Who?"

"The Baron Harkonnen."

"But . . ."

"Be quiet, please, my poor Duke. You haven't much time. In a moment, I will render you unconscious. You recall that peg tooth I put in your mouth after your tumble at Narcal? While you are unconscious, I shall remove that peg tooth and replace it with another." He opened his hand, stared at something in it. "An exact duplicate of the original tooth. It has a core shaped most exquisitely like a nerve. It will escape the usual detection methods, even a fast scanning. This tooth I'll put in your mouth, if you bite down hard on it, the cover will crush. Then, when you expel your breath sharply, you will fill the air around you with a deadly poison gas."

"But . . ."

"Do not try to talk, my poor Duke. You are dead anyway. But you will get close to the Baron before you die. He will believe you are stupified by drugs beyond any dying effort to attack him. And, in fact, you will be drugged . . . and tied. But you will remember the tooth. The tooth, Duke Leto Atreides. You will remember the tooth."

The old doctor leaned closer and closer until his face and the drooping mustache dominated Leto's narrowing vision.

"The tooth," Yueh muttered.

"Why?" Leto whispered.

Yueh lowered himself onto his knees beside the Duke. "I made a bargain with the Baron. It's probable he fulfilled his half of it, but I must be certain. When I see him, I will know. When I look at him, then I will know. And I will never enter his presence, even at a distance, without you as the price. But I will know when I see him. My Wanna taught me many things, and one is to see a certainty of truth when the stress is great enough. I cannot do it always, but I am sure I will know when I see the Baron."

"If you're . . ."

"Quiet! Do not waste your strength. Hah!" The purple lips turned up in a grimace. "I will not get close enough to the Baron, of this I am sure. I will be detained at a safe distance. Be sure of this. But you . . . ah, now! You! He will want you close to him, to gloat over you, and boast. Suitably drugged and restrained, of course."

Leto found himself almost hypnotized by a muscle on the left side of Yueh's jaw. The muscle twisted when the man spoke.

Yueh leaned closer. "And you, my good Duke, my precious Duke, must remember this tooth. It will be all that remains to you."

Leto's mouth moved without sound, then: "If . . . I . . . refuse?"

"In return for the tooth"—Yueh glanced down the hall, back to Leto—"in return, I will do a thing for you. I will save your son and your woman. No other can do it. They can be removed to a place where no Harkonnen can reach them."

Leto felt a sensation of fire in his throat, pressed the words out. "How . . . do . . . I . . . know . . . you . . ."

"That I'll carry out my part of the bargain? *You* know I'll do it. I wish only to kill a Harkonnen. You? You already were doomed."

"I . . ."

"Too much is concentrated against you, Duke Leto. You must believe it. Most of the CHOAM Company directors resent your inclusion amongst them. The Emperor does not permit possible rivals to live. And there're the Great Houses who resent your easy ways. You weren't wise to refuse marital alliance, you know."

He touched Leto's jaw, and there was a sensation of coldness in the jaw. "Oh, I know that's why you've never married your Lady. But it wasn't wise. Some people believe all non-friends are enemies, and the only friends are those of family alliance."

"How . . . save . . . them?" Leto whispered.

"By making it appear they're dead. By secreting them among people who spit at the name of Harkonnen, who hate the Harkonnens so much they'll burn a chair in which a Harkonnen has sat, salt the ground over which a Harkonnen has walked. Can you feel anything in your jaw?"

The Duke found that he could not answer. He sensed a distant tugging, saw Yueh's hand come up with the Ducal signet ring.

"For Paul," Yueh said. "You will be unconscious presently. Good-by, my poor Duke. When next we meet we'll have no time for more conversation."

Cool remoteness spread upward from Leto's jaw, across his cheeks. The hall narrowed to a pinpoint with Yueh's purplish lips centered in it.

"Remember the tooth!" Yueh hissed. "The tooth!"

XIX

There should be a science of discontent. People need hard times and oppression to develop psychic muscles.

"Collected Sayings of Muad'Dib"
by The Princess Irulan

Jessica awoke in the dark, feeling first a premonition in the stillness around her. She could not understand why her mind felt so sluggish. Skin raspings of fear ran along her nerves. She thought of sitting up and turning on the light, but something kept her from it . . . and her mouth felt . . . strange.

"Lump-lump-lump-lump!"

It was a dull sound, directionless in the dark.

The waiting moment was packed with time, with rustling needle-stick movements.

She began to feel her body, grew aware of bindings on wrists and ankles, a gag in her mouth. She was on her side, hands tied behind her.

Now, she remembered.

There had been movement in the darkness of her bedroom, something wet and pungent slapped against her face, filling her mouth, hands grasping her. She had gasped—one indrawn breath—sensing the narcotic in the wetness. Consciousness had receded, sinking her into a black bin of terror.

She tested her bonds. They were adhesive, tight.

It has come, she thought.

Slowly, she marshaled the inner calmness.

She grew aware of the smell of stale sweat with its chemical infusion of fear. *Where is Paul?* she asked herself. *My son—what have they done to him?*

Calmness.

But terror was so near.

Leto? Where are you, Leto?

She sensed a first diminishing of the dark. It began with shadows. Dimensions separated, became new thorns of awareness. White—a line under a door.

I'm on the floor.

Movement. She heard it through the floor.

She squeezed back the memory of terror. *I must remain calm, alert and prepared. I may get only one chance.* She *forced* the inner calmness.

The ungainly thumping of her heartbeats evened, shaping out time. She counted back. *I was unconscious about an hour.* She closed her eyes, focused her diffused awareness onto the approaching sounds.

Footsteps. She counted the different ones. *Four people.*

With the returned calm, her awareness grew. *I must pretend I'm still unconscious.* She relaxed against the cold hardness of the floor, testing her body's readiness.

She heard a door open, sensed the increased light through her eyelids.

Feet approached, someone standing over her.

"You are awake," rumbled a basso voice. "Do not pretend."

She opened her eyes.

It was the cellar room where Paul had slept. She saw his cot at one side—empty. Suspensor lamps were brought in, distributed near the open door. There was a glare of light in the hallway that hurt her eyes.

The Baron Valdimir Harkonnen stood over her. He wore a yellow cape that bulged over his portable suspensors. The fat cheeks were two cherubic mounds beneath spider-black eyes.

"The drug was timed," he rumbled. "We knew to the minute when you would be coming out of it."

How could that be? she asked herself. *They'd have to know my exact weight, my metabolism, my . . . Yueh!*

"Such a pity that you must remain gagged," the Baron said. "We could have such a very interesting conversation."

Yueh's the only one, she thought. *How could it be?*

The Baron glanced behind him at the door. "Come in, Piter."

She had never before seen the man who entered and stood beside the Baron, but the face was vaguely familiar—narrow and with hawk features. The blue-ink eyes suggested he was a native of Arrakis, but subtleties of movement and stance told her otherwise. And his flesh was too well firmed with water. He was tall, though, and slender, and something about him suggested effeminance.

"Such a pity we cannot have our conversation, my dear Lady Jessica," the Baron said. "However, we're aware of your abilities." He glanced at the other man. "Aren't we, Piter?"

"As you say, Baron," the man said.

The voice was tenor, and it touched her spine with a wash of coldness. She had never heard such a chill voice. To one with the Bene Gesserit training, that voice screamed: *Killer!*

"For Piter, I have a surprise," the Baron said. "He thinks he has come here merely to collect his reward—you, Lady Jessica. But I wish to demonstrate a thing—that he does not really want you."

"You play with me, Baron?" Piter asked, and he smiled.

Seeing the smile, Jessica wondered that the Baron did not leap to defend himself from this Piter. Then she inwardly corrected herself. The Baron could not read that smile. He did not have the *Training*.

"In many ways Piter is quite naïve," the Baron said. "He does not admit to himself what a deadly creature you are, Lady Jessica. I could show him, but it would be a foolish risk." The Baron smiled at Piter, whose face had become a waiting mask. "I know what Piter really wants. Piter wants power. And I am prepared to give him power."

"You promised me that I could have her," Piter said. The tenor voice had lost some of its cold reserve, and took on a subtle tremor.

Jessica, having studied the man, allowed herself an inward gasp. *He's a Mentat! How could he make such an animal out of a Mentat, this Baron?*

"And I always keep my promises," the Baron said. "I give you a choice, and if it remains your wish, you shall have her."

"What choice?"

The Baron snapped his fat fingers. "This woman and exile from the Imperium, or the Duchy of Atreides on Arrakis to rule as you see fit in my name."

Jessica watched the Baron's spider eyes study Piter.

"You could be a Duke here in all but name," the Baron said.

Is Leto dead then? Jessica asked herself. She felt a silent wail begin somewhere in her mind.

The Baron kept his attention on Piter. "Do you not understand yourself, Piter? You want this woman because she was a Duke's woman. She is a symbol of his power—beautiful, useful, exquisitely trained for her role. But an entire Duchy, Piter, is not just a symbol; it is reality. With it you could have many women. Not this woman, but others as desirable."

"You do not joke with Piter?"

The Baron turned toward Piter with that dancing lightness the suspensors gave his gross figure. "I do not joke. Remember—*I* am giving up the boy. You heard what the traitor said about the lad's training. Well, Piter?" The Baron smiled. "I must go now, but first I will send in a special guard. He is stone deaf. He has orders to convey you on the first leg of your journey into exile. His orders are to subdue this woman if he sees her gain control of you. He will not permit you to untie her gag until you are off Arrakis."

"You don't have to leave," Piter said. "I have chosen."

"Ah, hah!" the Baron said. "Such a quick decision can mean only one thing."

"I will take the Duchy," Piter said.

And Jessica thought: *Doesn't this Piter know the Baron has been lying to him? But . . . how could he know. He's only a twisted Mentat.*

The Baron glanced down at Jessica. "Is it not wonderful that I know Piter so well? I wagered with my Master at Arms that such would be Piter's choice. Hah! Well, I shall leave now. This is much better. Ah, much better. You understand, Lady Jessica. I hold no rancor toward you. It is a necessity. And much better this way. Yes. I shall not order you destroyed. When it is asked of me what happened to you, I can shrug it off in all truth."

"You leave it to me?" Piter asked.

"Whatever is done I leave to you," the Baron said. He stared at Piter. "Yes. There will be no blood on my hands here. It is your decision. I know nothing of it. To be sure of this, you will wait until I have gone. Well . . . ah, yes. Yes. Good."

He fears the questioning of a Truthsayer, Jessica thought. *Who? Ahhh, the Reverend Mother Gaius Helen, of course! If he knows he must face her questions, then the Emperor is in this dirtiness for certain. Ahhh, my poor Leto!*

With a last glance at Jessica, the Baron turned, went out the door. She followed him with her eyes, thinking: *It's as the Reverend Mother warned us—too potent an adversary.*

Two troopers in Harkonnen livery came in the door. Another trooper, his face a scarred mask, followed the pair, stood in the doorway with drawn handgun.

The deaf one, Jessica thought. She looked at the scarred face. *He's the one they'll order to kill me. That diabolical Baron! He knows I could use the Voice on any other man.*

Scarface glanced at Jessica, lifted his attention to Piter, spoke in a flat voice. "We have the boy on a litter outside. What are your orders?"

Piter spoke to Jessica. "I had thought of binding you to me by threatening your son, but now I suspect that might not have worked. It's as the Baron said. I let emotion cloud my reason. Bad policy for a Mentat." He looked at the first pair of troopers. "This is the way of it, then: Take them into the desert. Their bodies must never be found."

"You don't wish to dispatch them yourself?" one of the troopers asked.

They know him, Jessica thought.

"I follow my Baron's example," Piter said. "You heard where the traitor said to dispose of the bodies?"

"We heard."

"A worm must get all the evidence," Piter said.

"We know."

And Jessica heard the harsh Mentat control in Piter's voice. *He, too, fears the Truthsayer,* she thought.

Piter shrugged, turned and went through the doorway. He hesitated there, and Jessica thought he might turn back for a last look at her, but he went out without turning.

"Leaves it to us to do the dirty work," said one of the troopers. "Just like him." He aped Piter's voice: *"Their bodies must never be found.* Does he think we don't know what's going on?"

"You ain't ever likely to run into that old witch," the other trooper said. He went around to Jessica's head, bent over her. "And it ain't getting our work done by standing around here chattering. Take her feet and . . . "

"Why'n't we kill both of 'em here?" the other asked.

"Too messy," the first one said. "Unless you wants to strangle 'em. Me, I likes a nice straightforward job. Drop 'em on the desert, cut 'em once or twice, leave the evidence for the worms. Nothing to clean up afterwards."

"Yeah . . . well, I guess you're right," the other said.

Jessica listened to the voices, watched the men, *registering*. But the gag blocked her *Voice*, and there was the deaf one to consider.

They lifted her like a sack of grain, maneuvered her through the doorway and dumped her onto a suspensor-buoyed litter with another bound figure. As they turned her, fitting her to the litter, she saw her companion's face—Paul! He was bound, but not gagged. His face was no more than ten centimeters from hers, eyes closed, breathing even.

Is he drugged? she wondered.

The troopers lifted the litter, and Paul's eyes opened the smallest fraction—dark slits staring at her.

He mustn't try his Voice! she prayed. *The deaf guard!*

Paul's eyes closed.

He had been practicing the *awareness-breathing*, calming his mind, listening to their captors. The deaf one posed a problem, but Paul could not give himself up to despair. The mind-calming Bene Gesserit regimen his mother had taught him kept him poised, ready to expand any opportunity.

Paul allowed himself another slit-eyed inspection of his mother's face. She appeared unharmed. Gagged, though.

He wondered who could have captured her. His own captivity was odd enough—to bed with a medical capsule prescribed by Dr. Yueh, awakening to find himself bound to a litter. Perhaps a similar thing had befallen his mother. He had his own suspicions about the traitor now—Yueh. Logic said it could be no other. There was no understanding it yet, but understanding would come in time . . . if they lived.

The litter tipped slightly as the Harkonnen troopers maneuvered it through a door into the starlighted night. A suspensor bulb grated against the doorway. Then they were on sand, feet grating in it. A 'thopter wing loomed over them. The litter settled to the ground.

Paul's eyes adjusted to starlight. He recognized the deaf trooper as the man opened the 'thopter door, peered inside.

"This is one of them little liaison jobs," the deaf man rasped. "Ain't room in there for all of us."

One of the other troopers moved up close to the deaf one, presenting his lips for reading. "Czigo an' me, we can take care of it from here on."

"The Baron he told me to make sure about them two," the deaf one said.

"You think we can't do in a woman and a boy?" the trooper demanded. There was anger in his voice. "An' them tied?"

The deaf one said: "Well . . ."

"What you so worried about?" the trooper demanded.

"You will not remove her gag?" the deaf trooper asked.

"If you say," the trooper said.

"She is a Bene Gesserit witch," the deaf trooper said. "They have powers."

"Ahhhh . . ." The other trooper made the sign of the fist at his ear. "One of those, eh? Know watcha mean."

The trooper by the door grunted. "She'll be worm meat soon enough. Don't suppose even a Bene Gesserit witch has powers against one of them big worms. Yee-up." He crossed to the litter, bent over Jessica's head. "C'mon Czigo. Let's get this done."

With a casual efficiency, Jessica and Paul were jammed into the rear of the 'thopter, strapped down. Jessica recognized the 'thopter: one of the Duke's own and newly converted for desert reconnaissance.

The two troopers climbed into the front of the 'thopter, and the deaf man leaned across the controls on the left, peered up at the one who would pilot the craft.

"You will not remove the gag?"

"Don't worry your head none," the trooper said. "Now, stand clear."

The deaf one withdrew; the door slammed.

They took off in swift, wing-tucked surge, and the 'thopter settled into a swooping rhythm, headed south over the Shield Wall. The trooper at the controls said: "Best we don't use the jets for a while. Why'n't you turn around and keep an eye on them two?"

"Sure. You know the way?"

"I listened to the traitor same's you. Now keep your eye on them two."

The other guard swiveled his seat. Jessica saw the glint of starlight on a lasgun in his hand. The light-walled interior of the 'thopter seemed to collect illumination as her eyes adjusted, but the trooper's face remained in shadows. Jessica cautiously tested the seat belt, found it loose. She felt a roughness in the strap against her left arm, realized the strap had been almost cut through, would snap at any sudden jerk. In that instant, she discerned on the ceiling, scrawled large and easily visible in the dim light of the instrument panel, Yueh's house-sign. Yueh! She twisted slowly to bring her feet clear of Paul's.

"Sure do seem a shame to waste a good looking woman like that," the trooper facing them said. "Sure do seem a shame. Never had me no highborn types. You ever?"

"Bene Gesserits ain't all highborn," the pilot said.

"Yeah, but they all looks heighty."

And Jessica thought: *It just may be possible. Certainly he can see me here plain enough.* She brought her bound legs up onto the seat, curled into a sinuous ball, staring at the guard.

"Real pretty, she is," the trooper said. He wet his lips with his tongue. "Sure do seem a shame."

"You thinking what I think you're thinking?" the pilot asked.

"Who'd be to know?" the guard asked. "Afterwards . . ." He shrugged. "I just never had me no highborns. And I might never get a chance like this one again."

"You lay a hand on my mother . . ." Paul grated. He glared at the guard.

"Hey!" The guard laughed. "Cub's got a bark. He ain't got no bite, though."

And Jessica thought: *Paul's pitching his Voice too high! It may work, though.*

The 'thopter banked over the southern rim of the Shield Wall, and Jessica saw a shadowed expanse of sand beneath them.

"This oughta be far enough," the pilot said. He dipped the craft toward the sand in a long, falling stoop, brought it up stiffly over the dunes.

Jessica saw Paul begin taking the rhythmic breaths of the calming exercise. He closed his eyes, opened them. Jessica stared, helpless to aid him. *He hasn't mastered the Voice yet,* she thought. *If he fails . . .*

The 'thopter touched sand with a soft lurch, and Jessica, looking north back across the Shield Wall saw a shadow of wings settle out of sight up there.

Someone's following us! she thought. *Who?* Then—*The deaf one, of course. He's the only one who knows about us.*

Their pilot shut off his wing rotors. Silence flooded in upon them.

"What you say?" asked the guard.

Jessica turned her head. She could see out the window beyond the guard a dim glow of light from a rising moon, a frosted rim of rock rising from the desert. Sandblast ridges streaked its sides.

Paul cleared his throat.

The pilot said: "I dunno, Czigo."

"Ahh, look," said the guard. He reached out for Jessica's skirt.

"Remove her gag," Paul commanded.

Jessica felt the words rolling on the air. The tone, the timbre excellent—*imperative* very sharp. A slightly lower pitch would have been better, but it could still fall within this man's spectrum.

The guard shifted his hand up to the band around Jessica's mouth, began untying it.

"Stop that!" the pilot said. "You heard what . . ."

"Ah, shut your trap," the guard said. "Her hands're tied."

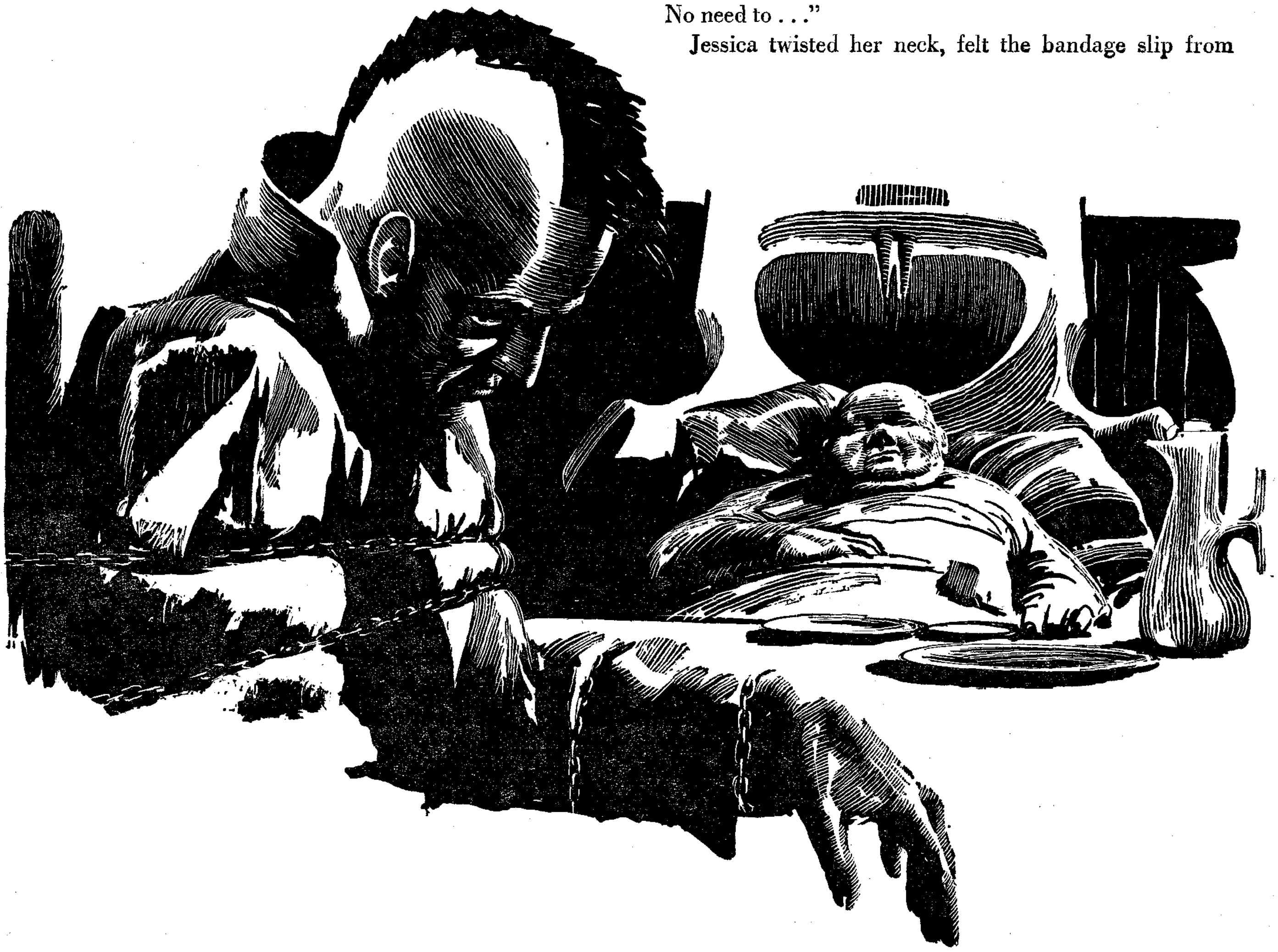
"Don't you tell *me* to shut my trap," the pilot said.

Jessica felt the binding around her mouth loosen.

"I'll tell you anything I want," the guard said. He freed the knot. His eyes glittered as they studied Jessica.

The pilot put a hand on the guard's arm. "Look, Czigo. No need to . . ."

Jessica twisted her neck, felt the bandage slip from



around her mouth. She spat out the gag, pitched her voice in low, intimate tones. "Gentlemen! No need to *fight* over me."

She saw them grow tense, knowing that in this instant they were convinced of the need to fight over her. Their disagreement now required no other reason. They *were* fighting over her in their minds.

"You mustn't disagree," she said, seeing them draw farther apart, glance warily at each other. "Is any woman worth fighting over?"

And by uttering the words, she made herself infinitely worth their fighting.

Paul clamped his lips tightly together, forced himself to silence. There had been one chance for him to succeed with the *Voice*. Now . . . everything depended on his mother, whose experience went so far beyond his.

"Yeah," the pilot said. "No need to fight over . . ."

His hand flashed, chopping toward the guard's neck. The blow was met by a splash of metal that caught the arm and in the same motion slammed into the pilot's chest.

The pilot grunted, sagged backward against his door.

"Thought I was some dummy didn't know that trick," the guard muttered. He brought back his hand, revealing the knife. It flashed in reflected moonlight.

"Now for the cub," the guard said. He leaned toward Paul with the knife.

"No need for that," Jessica murmured.

The guard hesitated.

"Wouldn't you rather have me co-operative?" Jessica asked. "Give the boy a chance." Her lip curled in a sneer. "Little enough chance he'd have out there in the sand. Give him that chance"—she smiled—"and you could find yourself well repaid."

The guard glanced left, right, returned his attention to Jessica. "I've heard me what can happen to a man on this desert," he said. "Boy might find the knife a kindness."

"Is it so much I ask?" Jessica asked.

"You're trying to trick me," the guard muttered.

"I don't want to see my boy die," Jessica said. "Is that a trick?"

The guard moved back, elbowed his door's latch. He grabbed Paul, dragged him across the seat, pushed him half out the door, held the knife poised. "What'll y' do, cub, if I cut y'r bonds?"

"He'll leave here immediately and head for those rocks," Jessica said.

"Is that what y'll do, cub?" the guard asked.

Paul's voice was properly surly. "Yes."

The knife moved down, slashed the bindings of his legs. He felt the hand on his back to hurl him down onto the sand, feigned a stumble against the door frame, and in turning as though to catch himself, lashed out with his right foot. The toe was aimed with a precision that did full credit to his long years of training. Almost every muscle of his body co-operated in the placement of it. The tip struck the soft part of the guard's abdomen just below the sternum, slammed upward with terrible force over the liver and through the diaphragm to crush the right ventricle of the man's heart.

With one gurgling scream, the guard jerked backward across the seats. Paul, unable to use his hands, continued his tumble onto the sand, landing with a roll that took up the force and brought him back to his feet in one motion. He saw his mother moving in the cabin.

Presently, Jessica joined him. She carried the guard's knife, stooped and slashed the bindings on Paul's hands.

"I could've handled him," she said. "That was a foolish risk."

Paul chafed his wrists. Words rose up in his mouth—that his father had taught him it was a matter of honor with the Atreides to protect their women—but thought of his father brought a sharp sense of fear.

"I saw the opening and used it," he said.

She heard the harsh control in his voice, turned back to the 'thopter. Yueh's house sign on the cabin ceiling and a strange loose bundle beneath the pilot's seat that she had felt during the flight—she had to investigate them. She reached into the cabin, seeing the dead guard's feet close to her face, feeling dampness on the strange bundle as she withdrew it, and realizing that must be the pilot's blood.

Paul stared around them, glimpsed a rock scarp lifting out of the desert like a beach rising from the sea, wind-carved palisades beyond it. He turned back as his mother lifted the bundle out of the 'thopter, saw that she was staring across the dunes toward the Shield Wall. He looked to see what drew her attention, saw another 'thopter swooping toward them, and realized they would not have time to clear the bodies out of their 'thopter and escape in it.

"Run, Paul!" Jessica shouted. "It's the deaf one!"

XX

Arrakis teaches the attitude of the knife—chopping off what's incomplete and saying: "Now, it's complete because it's ended here."

"Collected Sayings of Muad-Dib"
by The Princess Irulan

A man in Harkonnen uniform had skidded to a stop at the end of the hall, stared in at Yueh, taking in Mapes' body, the sprawled form of the Duke in a single glance. The man held a lasgun in his right hand. There was a casual air of brutality about him, a sense of toughness and poise that sent a shiver through Yueh.

Sardaukar, he thought. *A Bashar by the look of command about him. Probably one of the Emperor's own sent here to keep an eye on things. No matter what uniform they wear there's no disguising them.*

"You're Yueh," the man said. He looked speculatively at the Suk School ring on the doctor's hair, stared once at the diamond tattoo and then met Yueh's eyes.

The doctor straightened beside the unconscious Duke, lowered his eyes. "I am Yueh."

"You can relax, Yueh," the man said. "When you dropped the house shield we came right in. Everything's under control here. Is that the Duke?"

"Yes."

"Dead?"

"Merely unconscious. I suggest you tie him."

"Did you do for these others?" He glanced back down the main hall where Tuek's body lay, flicked his eyes over the sacklike form of Mapes.

"More's the pity," Yueh muttered.

"Pity!" the Sardaukar barked. He advanced, looked down at Leto. "So that's the great Red Duke."

If I had doubts about what he is, that would end them, Yueh thought. *Only the Emperor called the Atreides the Red Duke.*

The Sardaukar reached down, cut the red hawk insignia from Leto's uniform. "Little souvenir," he said. "Where's the Ducal signet ring?"

"He doesn't have it on him," Leto said.

"I can see that!" the Sardaukar snapped.

Yueh stiffened, swallowed. *If they press me, bring in a Truthsayer, they'll find out about Idaho.*

"Sometimes the Duke sent the ring with a messenger as token an order came directly from him," Yueh said.

"Must be trusted messengers," the Sardaukar muttered.

And Yueh thought: *How else could I have convinced Idaho?*

"Aren't you going to tie him?" Yueh asked.

"You recognize me, don't you," the Sardaukar said.

Yueh nodded.

"No matter," the Sardaukar said. "You'll not be telling anyone. How long did you say the Duke'll be unconscious?"

"I didn't say." Yueh glanced at Leto. "Two hours or so, give or take a few minutes. I wasn't as precise with his dosage as I was for the woman and boy."

The Sardaukar spurned the Duke with a toe. "This was nothing to fear even when armed, Yueh. When will the woman and boy awaken?"

"About ten minutes."

"So soon?"

"I was told the Baron would be here immediately behind his men."

"Correct," the Sardaukar said. "You will wait outside for him." He shot a hard stare at Yueh. "Now!"

"What about . . ." Yueh glanced at Leto.

"He'll be delivered to the Baron, all properly trussed like a roast ready for the oven." Again, the Sardaukar looked at the diamond tattoo on Yueh's forehead. "You'll be safe in the halls, Yueh. We were all told how to recognize you." His voice grew colder. "We've no more time for chatting, traitor. I hear the others coming."

He calls me traitor with a sneer in his voice, Yueh thought. He lowered his gaze, pressed past the trooper, obeying the order to leave. *Traitor,* Yueh thought. And he knew that this was a foretaste of how he would be remembered.

Slowly, Yueh walked toward the front entrance. He passed more bodies and Harkonnen guards who stared after him. He ignored all.

I must get the 'thopter, put the Ducal signet in the Fremkit, Yueh thought. They must know I tell the truth now. And a fear struck him.

If Idaho is impatient, Yueh thought, *if he doesn't wait and do exactly as I told him, Jessica and Paul will not be saved from this carnage. And if they aren't saved, I'll be denied even the smallest relief from this treachery.*

He saw himself abruptly as cast away in this place of destruction, spared nothing, given not the smallest pity. *Idaho must not fail,* he thought. *And I must be cautious and certain. It's their only chance.*

Hesitantly, every step betraying his inward battle for calmness, Yueh emerged from the house into flame-lighted night. The palms along the road had been fired to illuminate the house. Black smoke from the flammable used to ignite them poured upward through the flames.

A Harkonnen trooper grabbed Yueh's arm.

"It's the traitor," someone said. "Have him wait over there."

"The Baron wants to see you, traitor," another voice said.

Even when they've profited by me they despise me, Yueh thought. He straightened himself as he was pushed aside, regained some of his dignity. "And *I* want to see the Baron," he said.

"Yeah," someone laughed. "For what he must be paying you for this job, I don't blame you."

Yueh managed a knowing smile, walked with controlled casualness around the stone front of the house, entered the shadows away from the burning palms. Quickly, he made for the rear yard beneath the conservatory where the 'thopter waited, and one they had placed there to carry away Paul and his mother.

A guard stood at the open rear door of the house, but his attention was focused on the lighted hall and men banging through there from room to room. How confident they were!

Yueh hugged the shadows, worked his way around the 'thopter, eased open the door across from the guard. He felt under the front seats for the Fremkit, lifted its flap and slipped in the Ducal signet. He felt the crinkling of the spice paper on which he had written a note, pressed the ring into it, removed his hand and resealed the pack.

Softly, Yueh closed the 'thopter door, worked his way back and around the house.

Once more in the light of the blazing palm trees, Yueh pulled his cloak around him, stared at the flames. *Soon, I will know,* he thought. *Soon, I will see the Baron and I will know. And the Baron—he will encounter a small tooth.*

XXI

There is a legend that the instant the Duke Leto At-

reides died a meteor streaked across the skies above his ancestral palace on Caladan.

"Introduction to A Child's History of Muad'Dib"
by The Princess Irulan

The Baron Valdimir Harkonnen stood at a viewpoint of the grounded lighter he was using as a command post. Out the port he saw the flame-lighted night of Arrakeen. His attention focused on the distant Shield Wall where his *secret weapon* was doing its work.

Explosive artillery.

The guns nibbled at the caves where the Duke's fighting men had retreated for their last ditch stand. Slowly measured bites of orange glare, showers of rock and dust in the brief illumination—and the Duke's men were being sealed off to die by starvation, caught like animals in burrows.

The Baron could feel the distant chomping—a drumbeat carried to him through his ship's metal: *broomp . . . broomp*. Then: *BROOMP-broomp!*

Who would think of reviving the use of artillery in this day of shields? The thought was a chuckle in his mind. *But it was predictable the Duke's men would run for those caves. And the Emperor will appreciate my cleverness in preserving the lives of our mutual force.*

He adjusted one of the little suspensors that guarded his fat body against the pull of gravity. A smile creased his mouth, pulled at the lines of his jowls.

A pity to waste such fighting men as the Duke's, he thought. Then he smiled more broadly, laughing at himself. *Pity should be cruel!* He nodded. A failure was, by definition, expendable. The whole universe sat there, open to the man who could make the right decisions. The uncertain rabbits had to be exposed, made to run for their burrows. Else how could you control and breed them? He pictured his fighting men as bees routing the rabbits. And he thought: *The day hums sweetly when you have enough bees working for you.*

A door opened behind him. The Baron studied the reflection in the black viewport before turning.

Piter advanced into the chamber followed by Umman Kudu, the captain of the Baron's personal guard.

The Baron turned.

Piter touched finger to forelock in his half mocking salute. "Good news, M'Lord. The Sardaukar have brought in the Duke."

"Of course they have," the Baron rumbled.

And he studied the sober mask of villainy on Piter's effeminate face. And the eyes: those shaded slits of bluest blue-in-blue.

Some day soon I must remove him, the Baron thought. *He has almost outlasted his usefulness, almost reached a point of positive danger to my person. First, though, he must make the people of Arrakis hate him. Then . . . they will welcome my darling Feyd-Rauthe as a savior.*

The Baron shifted his attention to the guard captain, Umman Kudu: scissor-line of jaw muscles, chin like a boot toe—a man to be trusted because the captain's vices were known.

A man will do things for his vices he'd do on no other demand, the Baron thought.

"First, where is the traitor who gave me the Duke?" the Baron asked. "Where is he? I must give the traitor his reward."

Piter turned on one toe, motioned to the guard outside the door.

A bit of black movement there and Dr. Yueh walked through. His motions were stiff and stringy. The mustache drooped beside purple lips. Only the old eyes seemed alive. He came to a stop three paces into the room, obeying a motion from Piter, and stood there staring across the open space at the Baron.

"Ahhh, Dr. Yueh."

"M'Lord Harkonnen."

"You've given us the Duke, I hear."

"My half of the bargain, M'Lord."

The Baron looked at Dr. Yueh. "The letter of the bargain, eh? And I . . ." He spat the words out: "What was I to do in return?"

"You remember quite well, M'Lord Harkonnen."

And Yueh allowed himself to think now, hearing the loud silence of clocks in his mind. He had seen in the subtle betrayals of the Baron's manner that Wanna was, indeed, dead, gone far beyond their reach. Otherwise, there'd still be a hold on the *weak* doctor. The Baron showed that he had no hold; it was ended.

"Do I?" the Baron asked.

"You promised to deliver my Wanna from the agony," said Dr. Yueh.

The Baron nodded. "Oh, yes. Now, I remember. So I did. That was my promise. That was how we finally broke through your conditioning. You couldn't endure seeing your Bene Gesserit witch groveling in Piter's pain amplifiers. Not after we'd given you a taste of them, eh. Well, the Baron Valdimir Harkonnen always keeps his promises. I told you I would free her from her agony, and permit you to join her. So be it." He waved a hand to Piter.

Piter's blue eyes took on a glazed look. His motion was catlike in its sudden fluidity. The knife in his hand glistened like a claw as it flashed into Dr. Yueh's back.

The old man stiffened, never taking his attention from the Baron.

"So join her!" the Baron spat.

Dr. Yueh stood, swaying. His lips moved with careful precision, and his voice came in an oddly measured cadence: "You . . . think . . . you . . . de . . . feated . . . me. You . . . think . . . I . . . did . . . not . . . know . . . what . . . I . . . bought . . . for . . . my . . . Wanna."

He toppled. No bending or softening. It was like a tree falling.

"So join her," the Baron repeated. But his words were like a weak echo.

Dr. Yueh had filled him with a sense of foreboding. He whipped his attention to Piter, watched the man wipe the blade on a scrap of cloth, watched the creamy look of satisfaction in the blue eyes.

So he can kill by his own hand, the Baron thought. *It's well to know.*

"He *did* give us the Duke?" the Baron asked.

"Of a certainty, M'Lord," Piter said.

"Then get him in here!"

Piter glanced at the guard captain, who whirled to obey.

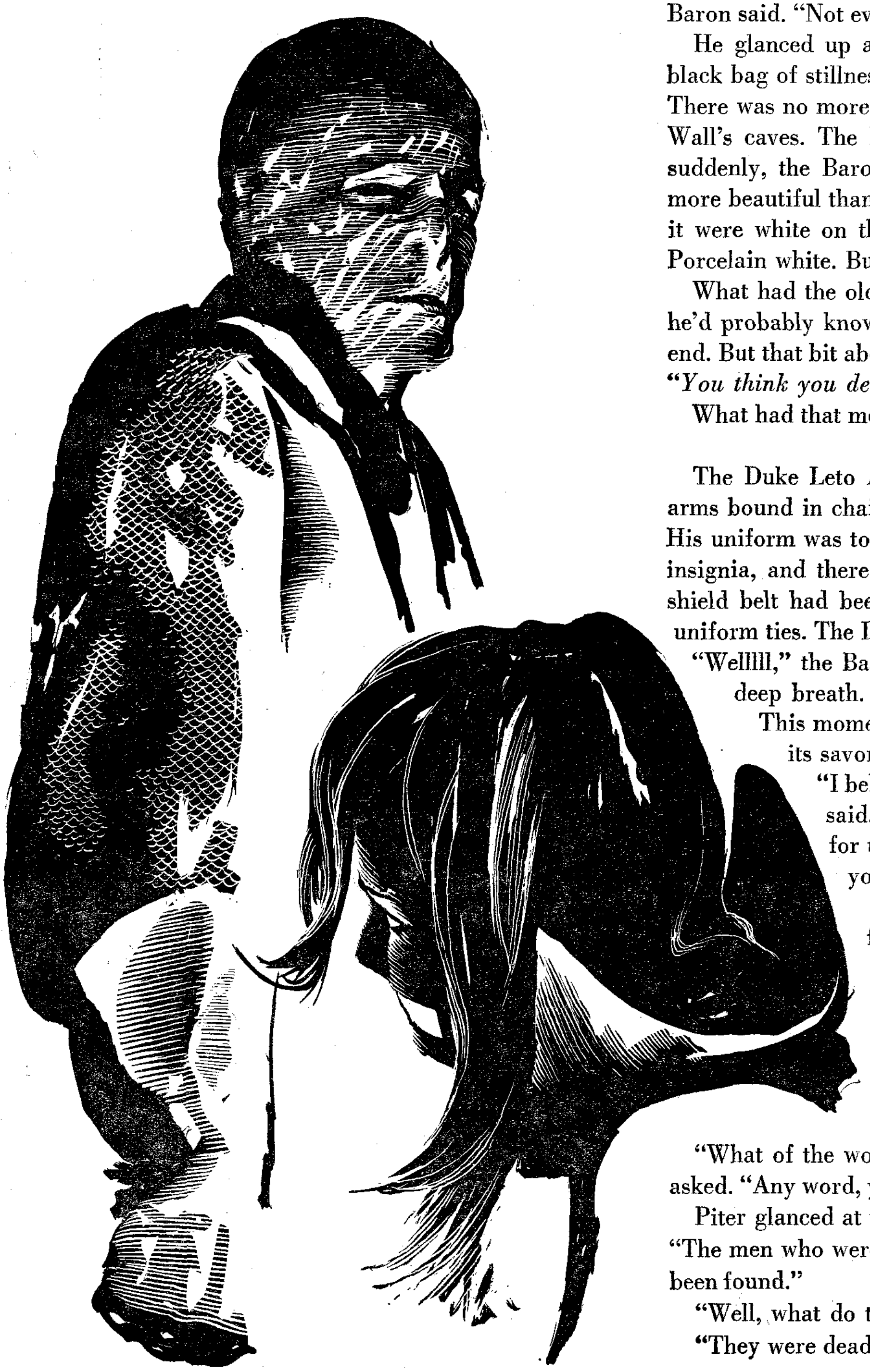
The Baron looked down at Dr. Yueh. From the way the man had fallen, you could suspect oak in him instead of bones, he thought.

"I never could bring myself to trust a traitor," the Baron said. "Not even a traitor I created."

He glanced up at the night-shrouded viewport. That black bag of stillness out there was his, the Baron knew. There was no more crump of artillery against the Shield Wall's caves. The burrow traps were sealed off. Quite suddenly, the Baron's mind could conceive of nothing more beautiful than that utter emptiness of black. Unless it were white on the black. Plated white on the black. Porcelain white. But there was still the feeling of doubt.

What had the old fool of a doctor meant? Of course, he'd probably known what would happen to him in the end. But that bit about thinking he had been defeated . . . "*You think you defeated me.*"

What had that meant?



The Duke Leto Atreides came through the door, his arms bound in chains, the eagle face streaked with dirt. His uniform was torn where someone had ripped off his insignia, and there were tatters at the waist where the shield belt had been removed without first freeing the uniform ties. The Duke's eyes held a glazed, insane look.

"Wellllll," the Baron said. He hesitated, drawing in a deep breath. He knew he had spoken too loudly. This moment, long envisioned, had lost some of its savor. *That cursed doctor!*

"I believe the good Duke is drugged," Piter said. "That's how the doctor caught him for us." Piter turned to the Duke. "Aren't you drugged, my dear Duke?"

The voice was far away. Leto could feel the chains, the ache of muscles, his own cracked lips, his burning cheeks, the dry taste of thirst whispering its grit in his mouth. But sounds were dull, hidden by a cottony blanket. And he saw only dim shape through the blankets.

"What of the woman and the boy, Piter?" the Baron asked. "Any word, yet?"

Piter glanced at the guard captain, back to the Baron. "The men who were sent to do the job, M'Lord. They've been found."

"Well, what do they report?"

"They were dead, M'Lord."

The Baron's face went livid. "And the woman and the boy?"

"No sign of them, M'Lord, but there was a worm . . . it came while the scene was being investigated. Possibly . . ."

"We do not deal in possibilities, Piter. What of the missing 'thopter? Does that suggest anything to you?"

"One of the Duke's men escaped with it, M'Lord. Killed our pilot and escaped. That seems clear enough."

"Which of the Duke's men?"

"It was a clean, silent killing, M'Lord. Hawat, perhaps. Or that Halleck one. Possibly Idaho. Or any of their top lieutenants."

"Possibilities," the Baron muttered. He glanced at the swaying, drugged figure of the Duke.

"The situation is in hand, M'Lord," Piter said.

"No it isn't! Where is that stupid planetologist? Where is this man, Kynes?

"We have a report of where to find him and he has been sent for, M'Lord."

"Where is the Ducal signet ring?" the Baron demanded. "His finger is bare!"

"It was not on him when we took him, M'Lord," the guard captain said.

"We killed the doctor too soon," the Baron said. "That was a mistake. You should have warned me, Piter."

The thought hung like a sine wave in Leto's mind: *Paul and Jessica have escaped!* There was something else in his memory: a bargain. He could almost remember it.

Someone had told him to remember the tooth. It was in his mouth. He could feel its shape with his tongue. All he had to do was bite sharply on it. But not yet! Someone had told him to wait until he was near the Baron. Who?

"How long will he remain drugged like this?" the Baron asked.

"Perhaps another hour, M'Lord."

Reality faded into blackness for Leto . . . then—

There was a table. Leto saw the table quite clearly. And a gross fat man on the other side of the table, the remains of a meal in front of him. Leto felt himself sitting in a chair across from the fat man, felt the chains, the straps that held him into the chair. He knew time had passed.

"I believe he's coming around, Baron."

"So I see, Piter."

Leto sensed increasing definition in his surroundings. The chair beneath him took on new firmness; the bindings that held him to the chair were sharper.

And he saw the Baron Valdimir Harkonnen. Leto saw the movements of the man's hands: compulsive touchings —the edge of a plate, the handle of a spoon, a finger tracing the round fold of the jowls.

"You can hear me, Duke Leto," the Baron said. "I know you hear me. We want to know from you where to find your concubine and the child you sired."

No sign escaped Leto, but the words were like a wash of calmness through him. *It's true, then,* he thought. *They don't have Paul and Jessica.*

"This is not a child's game we play with you," the Baron rumbled. "You must know that." He leaned toward Leto, studying the face. It pained the Baron that this could not be handled privately, just between the two of them. To have others see royalty in such straits—it set a bad precedent.

Leto could feel strength returning swiftly. Now, the memory of the false tooth stood out in his mind. The nerve-shaped capsule within that tooth—the poison gas—he remembered who had put the deadly weapon in his mouth.

Dr. Yueh.

A drug-fogged memory of seeing a limp corpse dragged past him in this room hung like a vapor in Leto's mind.

"Do you hear that noise, Duke Leto?" the Baron asked.

Leto grew conscious of a frog sound, the burred mewling of someone's pain.

"We caught one of your men disguised as a Fremen," the Baron said. "We penetrated the disguise quite easily. The eyes, you know. He tells us he was sent among the Fremen to spy on them. I've lived for a time on this planet, cher cousin. One does not spy on those ragged scum of the desert. Tell me, did you buy their help? Did you send your woman and your son among them?"

Leto felt the fear tighten his chest. *If Yueh sent Paul and Jessica among the desert folk . . . the Harkonnens won't stop the search until they're found.*

"Come, come," the Baron said. "We do not have much time and pain is quick. Please don't bring it to this, my dear Duke." The Baron looked up at Piter who stood at Leto's shoulder. "Piter doesn't have all his tools here, but I'm sure he could improvise."

"By all means, Baron."

That silky, insinuating voice! Leto heard it behind him, next to his ear.

"You had a plan in case we captured them," the Baron said. "Where have your woman and the boy been sent?"

The Baron stared into Leto's eyes.

"You don't answer," the Baron said. "Will you force me to do a thing I do not want to do? Piter will use simple, direct methods."

Leto suddenly recalled a thing Gurney Halleck had once said, seeing a picture of this Baron he hated: *"And I stood upon the sand of the sea and saw a beast rise up out of the sea . . . and upon his heads the name of blasphemy."*

"We waste time, Baron," Piter said.

"Perhaps." The Baron nodded. "You know, my dear Leto, that you will tell us in the end where they are. There's a level of pain that will buy your words."

The Baron picked up a sliver of meat in his fingers, pressed the morsel into his mouth. He chewed slowly, swallowed. *We must try a new tack,* he thought.

"Observe this prize person who denies he's for hire," the Baron said. "Observe him, Piter."

And the Baron thought: *Yes! See him there, this one* *who believes he cannot be bought. See him detained there by a million shares of himself he's sold in dribbles every second of his life! If you took him up now and shook him, he'd rattle inside. Emptied! Sold out! What difference how he dies now?*

The frog sounds in the background stopped. The Baron saw his guard captain, Umman Kudu, appear in the doorway across the room, shake his head. The captive had not produced the information they needed. Another failure. Time now to quit stalling with this fool Duke, this stupid soft fool who didn't realize how much hell there was so near him—just a nerve's thickness away.

This thought calmed the Baron, overcoming his reluctance to have a royal person subjected to pain. He suddenly saw himself as a kind of surgeon, exercising endless supple scissor dissections—cutting the masks away from fools to expose the hell beneath. *Rabbits, all of them!* And how they cowered when they saw the carnivore!

Leto stared across the table, wondering why he waited. The tooth would end it all quickly.

"Too bad," the Baron muttered. He pushed himself back from the table, stood up in his suspensors, hesitated, seeing a change come over the Duke. He saw the man draw in a deep breath, the jawline stiffen, the ripple of a muscle there as the Duke clamped his mouth shut.

How he fears me, the Baron thought.

Leto, shocked by fear that the Baron might escape him, had bitten sharply on the capsule tooth, felt it break. He opened his mouth, expelled the biting vapor he could taste as it formed on his tongue. The Baron seemed to grow smaller, a figure seen in a tightening tunnel. Leto heard a gasp beside his ear—the silky-voiced one: Piter. *It got him, too!*

"Piter! What's wrong?"

The rumbling voice was far away.

Leto sensed memories rolling in his mind like toothless mutterings. The room, the table, the Baron, a pair of terrified eyes—blue within blue—all compressing around him in ruined symmetry. There was a man with a boot-toe chin, a toy man falling. The toy man had a broken nose slanted to the left: an offbeat metronome caught forever at the start of an upward stroke. Leto heard the crash of crockery—so distant—a roaring in his ears. His mind was a bin without end, catching everything. Everything that had ever been—every shout, every whisper, every . . . silence.

One thought remained to him. Leto saw it in formless light on rays of black: *The day the flesh shapes and the flesh the day shapes.* The thought struck him with a sense of fullness that he knew he could never explain.

Silence.

The Baron Harkonnen stood with his back against his private door, his own bolt hole behind the table. He had slammed it on a room full of dead men. His senses took in guards swarming around him. *Did I breathe it?* he asked himself.

Sounds returned to him and reason. He heard someone shouting orders—gas masks . . . keep a door closed . . . get blowers going.

The others fell quickly, he thought. *I'm still standing. I'm still breathing. Merciless hell! That was close!*

He could analyze it now. His shield had been activated, set low but still enough to slow molecular interchange across the barrier. And he had been pushing himself away from the table . . . that and Piter's shocked gasp which had brought the guard captain darting forward into his own doom. Chance and the warning in a dying man's gasp—these had saved him.

But the Baron felt no gratitude to Piter. The fool had got himself killed. And that stupid guard captain! He'd said he scoped everyone before bringing them into the Baron's presence! How had it been possible for the Duke . . . *Well, no matter,* the Baron thought, his mind firming. *The next guard captain will begin by finding an answer to that question.*

He grew aware of more activity around a corner of the metallic corridor—around there at the other door to that room of death. The Baron pushed himself away from his own door, studied the lackeys around him. They stood there, staring, silent, waiting for his reaction. *Would the Baron be angry?* And he realized that only a few seconds had passed since his flight from that room.

Some of the guards had weapons leveled at the door. Some were directing their ferocity toward the empty hall that stretched away to the right.

A man came striding around the corner from the opposite direction, gas mask dangling by its strap at his neck, his eyes intent on the overhead poison snoopers that lined the corridor. He was a yellow-haired man, flat face and green eyes, crisp lines radiating from a thick-lipped mouth. He looked like some water creature misplaced among those who walked the dry land.

The Baron stared at the approaching man, recalling the name: Nefud. Iakin Nefud. Guard corporal. Nefud was addicted to *semuta,* the drug-music combination that played itself in the deepest consciousness. A useful item of information, that.

The man stopped in front of the Baron, saluted. "The corridors are clear, M'Lord. I was outside the door, watching, and saw that it must be poison gas. Ventilators in your room were pulling air from these corridors." He glanced at the snooper over the Baron's head. "None of the stuff escaped. We have the room cleaned out now. What are your orders?"

The Baron recognized the voice that had been shouting orders. *Efficient, this corporal,* he thought. *Well, we must adjust.*

"First," the Baron said, "let me congratulate you, Nefud. You are the new captain of my guard. And I hope you will take to heart the lesson to be learned from the fate of your predecessor."

The Baron watched awareness grow in the face of the newly promoted guardsman. Nefud knew he would never again be without his *semuta.*

Nefud nodded. "My Lord knows I will devote myself entirely to his safety."

"Yes. Well, as to my orders. The Duke had something in his mouth, I suspect. You will find out what it was, how it was used, who helped him put it there. You will take every precaution to . . ."

He stopped, his chain of thought broken by a disturbance in the corridor behind him—guards at the lift from the lower levels of the lighter trying to hold back a tall colonel who had just emerged from the lift with them.

The Baron couldn't place the colonel's face: thin-featured, eyes like twin ink spots, mouth like a slash in leather.

"Get your hands off me you pack of carrion-eaters!" the man roared, and he dashed the guards aside, strode toward the Baron. "I came to see you, Baron!"

Ahhh, one of the Sardaukar, the Baron thought. His eyes went to slits, studying the approaching man.

The man stopped, planting himself half a pace in front of the Baron, hands on hips. The guard hovered him in twitching uncertainty.

The Baron noted the lack of salute, the disdainful manner of the Sardaukar, and his unease grew. There was only one Legion of them in Arrakeen, but the Baron did not fool himself. That one Legion was perfectly capable of turning on the Harkonnen mercenaries and overcoming them.

"I came to see you, Baron," the colonel snapped. "One of our platoons brought the Atreides Duke before I could discuss it with you."

I must not lose face in front of my men, the Baron thought.

"My Emperor has charged me to make certain that his royal cousin dies swiftly and cleanly, without agony," the colonel said.

The Padishah Emperor does not trust me, the Baron thought.

"Such were the Imperial orders to me," the Baron lied. "Did you think I would disobey?"

"My duty is only to act on my Emperor's orders," the colonel said.

"The Duke is already dead," the Baron said, and he waved a hand to dismiss the fellow.

The colonel remained planted facing the Baron. Not by a flicker of the eyes or muscles did he acknowledge that he had been dismissed. "How?" he growled.

Really! the Baron thought. *This is too much.*

"By his own hand, if you must know," the Baron snapped. "He took poison."

"I will see with my own eyes," the colonel said.

The Baron raised his gaze to the ceiling in feigned exasperation while his thoughts raced. *Damnation! This sharp-eyed Sardaukar beast would see the room before a thing had been changed!*

There was no helping it, the Baron realized. The Sardaukar would see all. He'd know that the Duke killed Harkonnen men in dying . . . that the Baron most likely had escaped by a narrow margin. There was the evidence of the plate on the table, the just completed meal, and the dead Duke across the table with destruction around him.

"I will not be put off!" the colonel snarled.

"You're not being put off," the Baron said, and he stared into the obsidian eyes of the Sardaukar. "I hide nothing from my Emperor." He nodded to Nefud. "The colonel is to see everything. At once. Take him in by the door where you stood, Nefud."

"This way, colonel," Nefud said.

Slowly, insolently, the colonel moved around the Baron, shouldering a way through the guardsmen.

Insufferable, the Baron thought. *Now, the Emperor will know how I slipped up. He will recognize it as a sign of weakness.*

And it was an agonizing thing to realize that the Padishah Emperor and his Sardaukar were alike in their disdain for weakness. At least they hadn't learned of the Atreides raid on Giedi Prime, the destruction of the spice stores there.

The Baron watched the retreating backs—the arrogant Sardaukar and the stocky, efficient Nefud.

We must adjust, the Baron thought. *I will have to put Rabban over this planet once more. Without restraint. I must spend him, my own Harkonnen blood, to put Arrakis into a proper condition for accepting Feyd-Rautha.*

The Baron sighed.

And I must send at once to Tielax for a new Mentat. They must have one ready for me by now.

One of the guardsmen beside him coughed.

The Baron turned toward the man. "I am hungry."

"Yes, My Lord."

"And clear out this room and study its secrets for me," the Baron rumbled.

The guardsman lowered his eyes. "Yes, M'Lord."

"I will be in my resting chambers."

The Baron turned away, began moving ponderously toward his chambers.

XXII

O, Seas of Caladan,
O, people of Duke Leto—
Citadel of Leto fallen,
Fallen forever . . .

"Songs of Muad'Dib"
by The Princess Irulan

Paul felt that all his past, every experience before this night, had become sand curling in an hourglass. He sat near his mother hugging his knees in a small fabric and plastic hutment—a stilltent—that had come like the Fremen clothing they now wore from the pack left in the 'thopter. And there was no doubt who had put it there, who had directed where the 'thopter carrying them as captives should go.

Yueh!

The traitor-doctor had sent them directly into the hands of a trusted friend—Duncan Idaho.

Paul stared out the transparent end of the stilltent at the moonshadowed rocks which ringed this place where Idaho had hidden them. *Hiding like a child when I am now the Duke,* he thought, and felt the thought gall him.

He could not deny the wisdom in what they did, though. Something had happened to his awareness this night—he saw with sharpened clarity every circumstance and occurrence around him. He felt unable to stop the inflow of data nor the cold precision with which each new item was added to his knowledge and the computation centered in his awareness.

Paul thought back to the moment of impotent rage as the strange 'thopter dived out of the night onto them, stooping like a giant hawk above the desert with the wind screaming through its wings. The thing in his mind had happened then. The 'thopter had skidded and slewed across a sand ridge toward the running figures—his mother and himself.

His mother, he knew, had turned, expecting to meet a lasgun in the hands of the deaf guard, and had recognized Duncan Idaho leaning out of the open door, shouting: "Hurry! There's a wormsign south of you!"

But Paul had known as he turned who piloted the 'thopter. An accumulation of minutae in the way it was flown, the dash of the landing—clues so small that even his mother could not detect them—had told Paul *precisely* who sat at these controls.

Across the stillent from Paul, Jessica stirred, said: "There can be only one explanation. The Harkonnens held Yueh's wife. He hated the Harkonnens! I cannot be wrong about that. You read his note. But why has he saved the two of us from this carnage?"

She is only now seeing it, Paul thought, and the thought was a shock. He had known this as a by-the-way thing while reading the note that had accompanied the Ducal signet in the pack.

"Do not try to forgive me," Yueh had written. "I do not want your forgiveness, for I already have enough burdens. What I have done I have done without malice nor hope of another's understanding. It is my own *tahaddi al-burhan,* my ultimate test. I give you the Atreides Ducal signet as token that I write truly. By the time you read this, Duke Leto will be dead. Take consolation from my assurance that he did not die alone, that one we hate above all others died with him."

It had not been addressed or signed, but there was no doubt of the familiar scrawl—Yueh's.

Remembering the letter, Paul re-experienced the distress of that moment—a thing sharp and strange that seemed to happen outside his new mental alertness. He had read that his father was dead, known the truth of the words, but had felt them as no more than another datum to be entered in his mind and used.

I loved my father, Paul thought, and he knew this for truth. *I should mourn him . . . I should feel something.*

But he had felt nothing except: *Here is an important fact.*

Gurney Halleck's words suddenly came back to Paul: "*Mood's a thing for cattle or for making love. You fight when the necessity arises, no matter your mood.*"

Perhaps that's it, Paul thought. *I'll mourn my father later . . . when there's time.* But he could feel no letup in the cold precision of his being.

He felt that his new awareness was only a beginning, that it was growing. The sense of Terrible Purpose that he had first experienced in his ordeal with the Reverend Mother Gaius Helen Mohiam pervaded him. His right hand—the hand of remembered pain, tingled and throbbed. *Is this what it is to be their Kwisatz Haderach?* he wondered.

"For a while, I thought Hawat had failed us again," Jessica said. "I thought perhaps Yueh wasn't a Suk doctor, that he was a fake."

"No," Paul said. "He was everything we thought him . . . and more."

Jessica nodded in the gray darkness of the tent. She stared at Paul across from her, a silhouette against moonfrosted rocks. "They chose their traitor well," she said "—an old man defenseless against bestiality, whose strongest tie had become that to his Bene Gesserit wife. He was tied to her by long years of tenderness and sharing. His school and its imprint were far behind. They reached him through his wife."

Why is she so slow in seeing these things? Paul wondered. And he said: "If Idaho doesn't get through to that planetologist, we'll be . . ."

"He's not our only hope," she said.

"Such was not my suggestion," he said.

"Others among your father's men will have escaped," she said. "We must endeavor to regather them, to find . . ."

"We will depend upon ourselves," he said. "Our immediate concern is our Family atomics. We must get them before the Harkonnens can search them out."

"Not likely they'll be found," she said, "the way they were hidden."

"It must not be left to chance," he said.

And she thought: *Blackmail with the Family atomics as a threat to the planet and its spice—that's what he has in mind. But all he can hope for then is escape into renegade anonymity.*

His mother's words had provoked another train of thought in Paul—a Duke's concern for all the people they had lost this night. *People are the true strength of a Great House,* he thought. And he remembered Hawat's words: "*Parting with people is a sadness. A place is only a place.*"

"We must wait," Jessica said. "They're using Sardaukar. We must wait until the Sardaukar have been withdrawn. They cannot go on risking exposure of the Emperor's involvement in this."

"Perhaps," Paul said. "But they think us caught between the desert and the Sardaukar, and they intend there to be no Atreides survivors—total extermination. Do not count on many of our people escaping."

"Some are bound to."

"Are they?"

Jessica turned away, hearing the bitter strength in her son's voice—the precise assessment of chances. She sensed that his mind had leaped ahead of her, that it now saw more in some respects than she did. She had helped train the intelligence which did this, but she suddenly found herself afraid of it. Her thoughts turned, seeking toward the lost sanctuary of her Duke, and she felt tears burn her eyes.

This is the way it had to be, Leto, she thought: *"A time of love and a time of grief."*

"Try the communinet receiver again," Paul said. "See if the static has lowered."

The mind goes on working no matter how we seek to hold it back, she thought. She found the tiny receiver Idaho had left them, flipped its switch. A green light glowed on the instrument's face, and a tinny screeching came from its speaker. She reduced the volume, hunted across the bands. A voice speaking the Atreides battle language came into the tent.

". . . Back and regroup at the ridge. Fedor reports no survivors in Carthag and the Guild Bank has been sacked."

Carthag! Jessica thought. *But that was a Harkonnen stronghold.*

"They're Sardaukar," the voice said. "Watch out for Sardaukar wearing Atreides uniforms. They're . . ."

A roaring filled the speaker, then silence.

"Try the other bands," Paul said.

"Do you realize what this means?" Jessica said.

"Yes. I expected it. They mean for the Guild to blame us in the destruction of their bank. With the Guild against us, we're trapped on Arrakis. Try the other bands."

Weighing his words—*"I expected it"* —Jessica returned to the instrument. As she moved the band slide, broken glimpses of violence emerged from a few voices calling out in the Atreides battle language—". . . Fall back . . ." ". . . Try to regroup at . . ." ". . . Trapped in a cave at . . ."

And there was no mistaking the victorious exhultation in the Harkonnen gibberish that poured from other bands. Sharp commands—battle reports. There wasn't enough of it for Jessica to register and break the language, but the tone was obvious.

Harkonnen victory!

Paul shook the pack beside him, hearing the two literjons of water gurgle there. He took a deep breath, looked up through the transparent end of the tent at the rock escarpment outlined against the stars. His left hand felt the sphincter-seal of the tent's entrance. "It'll be dawn soon," he said. "We can wait through the day for Idaho, but not through another night. In the desert you must travel by night and rest in shade through the day."

Remembered lore insinuated itself into Jessica's mind: *Without a stillsuit, a man sitting in shade on the desert needs five liters of water a day to maintain body weight.* She felt the slick-soft skin of the stillsuit against her body, thinking how their lives depended on these garments.

"If we leave here, Idaho cannot find us," she said.

"There are ways of making any man talk," he said. "If Idaho hasn't returned by midnight, we must consider the possibility he has been captured."

Paul opened the tab seal on the pack, lifted a tiny micromanual with glow tab and magnifier from it. Green and orange letters leaped up at him from the pages: "literjons, stilltent, energy caps, recaths, sandsnork, binoculars, stillsuit repkit, baradye pistol, sinkchart, filt-plugs, paracompass, maker hooks, thumpers, Fremkit . . ." So many things for survival on the desert. Presently he put the manual aside on the tent floor.

"Where can we possibly go?" Jessica asked.

"My father spoke of *desert power,*" Paul said. "The Harkonnens cannot rule this planet without it. They have never ruled this planet, nor shall they. Not even with ten thousand legions of Sardaukar."

"Paul, you cannot think that . . ."

"We have all the evidence in our hands," he said. "Right here—this tent, this pack and its contents, these stillsuits. We know the Guild wants a prohibitive price for weather-control satellites. We know that . . ."

"What've weather-control sat . . ." She broke off.

Paul could sense the hyper-alertness of his mind reading her reactions, computing on minutae. "You see it now," he said. "Satellites watch the terrain below. There are things in the deep desert that will not bear frequent inspection."

"You're suggesting that the Guild itself controls this planet?"

"No . . . the Fremen. They're paying the Guild for privacy, paying in a coin that's freely available to anyone with desert power—the spice. This is more than a first-approximation answer; it's the straight-line computation. You may depend on it."

"Paul," Jessica said, "You're not yet a Mentat; you can't know for sure how . . ."

"I'll never be a Mentat," he said. "I'm something else . . . a freak."

"Paul! How can you say . . ."

"Leave me alone!" He turned away from her, looking out into the night. *Why can't I mourn?* he wondered. He felt that every fiber of his being wanted this release but that it would be denied him forever.

Jessica had never heard such distress in her son's voice. She wanted to reach out to him, hold him, comfort him, to help him—but she sensed there was nothing she could do. He had to solve his problem by himself.

The glowing tab of the Fremkit manual between them on the tent floor caught her eye. She lifted it, glanced at the flyleaf, reading: "Manual of 'The Friendly Desert,' the place full of life." She turned the page, read: "Here are the *ayat* and *burhan* of Life. Believe, and al-Lat will will never burn you."

It reads like the Azhar Book, she thought. And she recalled the copy of it they had studied at school in the training on Great Secrets. *Has a manipulator of religious been here?* she wondered.

"A strange manual," Paul said, "—both religious and practical."

"It's like the Azhar Book," she said.

"Here, they call it the Kitab al-Ibar," he said.

Jessica turned another page, read: "God give us water in torrents that we may bring forth vegetation and grain and gardens luxuriant."

How does he know what it's called here? she asked herself. *Is it another of his prescient dreams?*

Paul lifted the paracompass from the pack, returned it, said. "Think of these artifacts, think of these suits we wear—think of these stillsuits as machines. All of these . . . machines, show a sophistication unrivaled in our universe. They're special application machines superior in conception even to those of Tupile or Richessa. The Fremen culture behind them has depths no one has suspected."

Hesitating, still worried by the harshness in his voice, Jessica returned her attention to the book in her hands, turned up an illustration—a constellation from the sky of Arrakis. The captain called it "Muad'Dib: The Mouse" and noted that the tail pointed north.

Paul stared into the tent's darkness at the dimly discerned movements of his mother revealed by the manual's glowtab. *Now is the time to carry out my father's wish,* he thought. *I must give her his message now while she has time for grief. The grief would inconvenience us later.* And he found himself shocked by the precise logic of the decision.

"Mother," he said.

"Yes?" She heard the change in his voice.

"My father is dead," he said.

She searched within herself for the coupling of fact and fact and fact ad infinitum—the Bene Gesserit Way of assessing data, and she felt the sensation of terrifying loss. Jessica nodded, unable to speak.

"My father charged me once," Paul said, "to give you a message if anything happened to him. He feared that you might believe he distrusted you."

Idaho and Hawat and that useless suspicion, she thought.

"He wanted you to know that he never suspected you," Paul said, and explained the deception, adding: "He wanted you to know that he always trusted you completely, always loved you and cherished you. He said he would sooner mistrust himself and that he had one regret—that he had not made you his Duchess."

She brushed at tears coursing down her cheeks, thought: *What a stupid waste of the body's water!* But she knew this thought for what it was—the attempt to retreat from grief into anger. *Leto, my Leto,* she thought. *What terrible things we do to those we love!* With a violent motion, she extinguished the manual's glowtab.

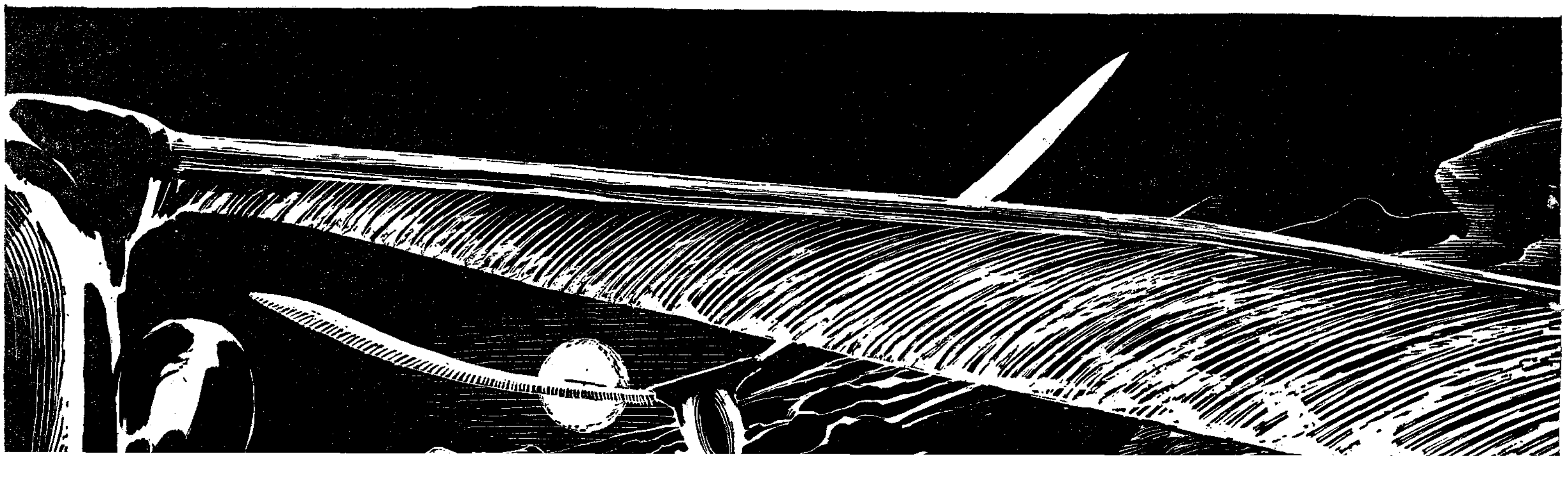
Sobs shook her.

Paul heard his mother's grief and felt the emptiness within himself. *I have no grief,* he thought. *Why? Why?* He felt the inability as a terrible flaw.

"A time to get and a time to lose," Jessica thought, quoting to herself from the OC Bible. *"A time to keep and a time to cast away; a time to love and a time to hate; a time of war and a time of peace."*

But Paul's mind had gone on in its chilling precision. He saw the avenues ahead of them on this seemingly hostile planet. Without even the safety-valve of dreaming, he focused on his prescient awareness, seeing it as a computation of *most-probable* futures, but with something more, an edge of mystery, as though his mind dipped into some timeless stratum and sampled the winds of the future.

Abruptly, as though he had found a necessary key,



Paul's mind climbed another step in awareness. He felt himself clinging to this new level, clutching at some precarious hold and peering about. It was as though he existed within a globe with avenues radiating away in all directions . . . yet this only approximated the sensation.

He remembered once seeing a gauze kerchief blowing in the wind and now he sensed the future as though it twisted across some surface as undulant and impermanent as that of the windblown kerchief . . . he saw Time blowing the kerchief. He saw people. He felt the heat and cold of uncounted probabilities. He knew names and places, experienced emotions without number, reviewed data of innumerable unexplored crannies. There was time to probe and test and taste . . . but no time to shape.

The thing was a spectrum of possibilities from the most remote past to the most remote future—from the most probable to the most improbable. He saw his own death in countless ways—he saw new planets, new cultures, people . . . people . . . in such swarms they could not be listed—yet his mind catalogued them.

Even the Guildsmen.

And he thought: *The Guild—there would be a way for us—my strangeness a familiar thing to them and with a high value.* But the idea of living out his life in the groping-ahead-through-possible-futures that guided hurtling spaceships appalled him. It *was* a way, though. In meeting the *possible future* that contained Guildsmen, he recognized his own strangeness—*another kind of sight. I see another kind of terrain: the available paths.*

As swiftly as it had come, the sensation slipped away from him, and he realized that the entire experience had happened within the space of a heartbeat.

Yet his own personal awareness had been turned over, illumined in a terrifying way. He stared around him.

Night still covered their stilltent within its rock enclosed hideaway.

His mother's grief could still be heard.

His own lack of grief could still be felt . . . that hollow place somewhere separated from his mind which went on its steady pace—dealing with data, evaluating, computing, submitting answers. And now he saw that he had a wealth of data few such minds ever before had encompassed. But this made the empty place no easier to bear. He felt that something must shatter within him. It was as though a clockwork control for a bomb had been set to ticking within him. It went on about its business no matter what he wanted. It recorded minuscule shadings of difference around him—a slight change in moisture, a fractional fall in temperature, the progress of an insect across their tent roof, the solemn approach of dawn in the starlighted patch of sky he could see out the tent's transparent end.

The emptiness was unbearable. Knowing how the clockwork had been set in motion made no difference. He could look to his own past and see the start of it—the training, the sharpening of talents, the refined pressures of sophisticated disciplines, even exposure to the OC Bible at a critical moment. And he could look ahead—the most terrifying direction—to see where it all pointed.

I'm a monster! he thought. *A freak!*

"No," he said. Then: "No. No! NO!"

He found that he was pounding the tent floor with his fists. (The implacable part of him recorded this as an interesting datum and fed it into computation.)

"Paul!"

His mother was beside him, holding his hands, her face a gray blob peering at him. "Paul, what's wrong?"

"You!" he said.

"I'm here, Paul," she said. "It's all right."

"What have you done to me?" he demanded.

In a burst of clarity, she sensed some of the roots in the question, said: "I gave birth to you."

It was, from instinct as much as from her own subtle knowledge, the precisely correct answer to calm him. He felt her hands holding him, focused on the dim outline of her face.

(Certain gene traces in her facial structure were noted in a new way by his onflowing-mind, the clues added to other new data, and a second-approximation answer put forward.)

"Let go of me," he said.

She heard the iron in his voice and obeyed. "Do you want to tell me what's wrong, Paul?"

"Did you know what you were doing when you trained me?" he asked.

There's no more childhood in his voice, she thought. And she said: "I hoped the thing any parent hopes—that you'd be . . . superior . . . different."

"Different?"

She heard the bitterness in his tone, said: "Paul, I . . ."

"You didn't want a son," he said, "you wanted a *Kwisatz Haderach!* You wanted a male Bene Gesserit!"

"But, Paul . . ."

"Did you ever consult my father in this?"

She spoke gently out of the freshness of her grief: "Whatever you are, Paul, the heredity is as much your father as me."

"But not the training," he said. "Not the things that . . . awakened . . . the . . . sleeper."

"Sleeper?"

"It's here." He put his hands to his head and breast. "In me. It goes on and on and on . . ."

"Paul!"

She had heard the hysteria at the edge of his voice.

"Listen to me," he said. "You wanted the Reverend Mother to hear about my dreams. You listen in her place, now. I've just had a *dream* for you—a walking dream. Do you know why?"

"You must calm yourself, Paul," she said. "If you have something you want to . . ."

"The spice," he said. "It's in everything here—the air, the soil, the food. The *geriatric* spice. It's a poison!"

His voice lowered and he repeated: "A poison—so subtle, so insidious . . . so irreversible. It won't even kill you unless you stop taking it. We cannot leave Arrakis unless we take part of Arrakis with us."

The terrifying *presence of* his voice brooked no dispute.

"You and the spice," Paul said. "What I inherited from you, what I learned from you—they met the spice and were changed."

Then we are trapped here, she thought.

No pressure of the Bene Gesserit, no trickery could pry them completely free from this place: the spice was addictive. And she accepted the truth of this. Her body had known the fact long before the mind awakened to it.

So here we live out our lives, she thought . . . *on this hell-planet. Well—the place has been prepared for us, if we can evade the Harkonnens. And there's no doubt of my course.*

"I must tell you about my waking dream," Paul said. (She heard fury in his voice.) "To be sure you accept the truth of what I say, let me tell you first a thing I know: you'll bear a daughter here on Arrakis. My sister."

Jessica placed her hands against the tent floor, pressed back against the curving fabric wall to still a sudden pang of fear. She knew that her pregnancy could not show yet. Only her own Bene Gesserit training had allowed her to read the first faint signals of her body, to know of the embryo only a few weeks old.

"Only To Serve," Jessica whispered, clinging to the Bene Gesserit motto. *"We Exist Only To Serve."*

"We'll find a home among the Fremen," Paul said, "where your Missionaria Protectiva has bought us a bolt hole."

They have prepared a way for us in the desert, Jessica told herself. *But how can he know of the Missionaria Protectiva?* She found it increasingly difficult to subdue her terror at the overpowering strangeness in Paul.

He studied the dark shadow of her, seeing her fear and every reaction with his new awareness as though she were outlined in blinding light. A beginning of compassion for her crept over him.

"The things that can happen here, I cannot begin to tell you," he said. "I cannot even begin to tell myself, although I've seen them. This *sense* of the future, this . . . testing the probabilities . . . I seem to have no control over it. The thing just happens. But the immediate future—say, a year—I can see some of that . . . road as broad as our Central Avenue on Caladan. There are places, of course . . . shadowed places . . . as though it went behind a hill—and again he thought of the surface of a blowing kerchief— . . . and there are branchings . . ."

He fell silent as memory of that *seeing* filled him. No prescient dream, no experience of his life had quite prepared him for the totality with which the veils had been ripped away to reveal naked Time. He recalled the experience, recognizing his own Terrible Purpose—the pressure of his life spreading outward like an expanding bubble and Time retreating before it.

Jessica found the tent's glowtab control, activated it. Dim green light drove back the shadows, easing her fear. She looked at Paul's face, his eyes—the inward stare. And she knew where she had seen such looks before—pictured in records of disasters—on the faces of children who experienced starvation or terrible injury: eyes like pits, mouth a straight line, cheeks indrawn.

It's the look of terrible awareness, she thought, *of someone who has been forced to the knowledge of his own mortality.*

He was, indeed, no longer a child.

The underlying import of his words began to take over in her mind, pushing fear farther aside. Paul could see ahead . . . a way of survival for them among the desert people . . . a way of escape from the Harkonnens.

"There's a way to evade the Harkonnens," she said.

"The Harkonnens!" he sneered. "Put them out of your mind. The twisted humans shall be untwisted and made to see themselves as they truly are. Do not fear the Harkonnens."

And he thought: *No, don't fear the Harkonnens; fear the Sardaukar.* He stared at his mother, studying the lines of her face in the light of the glowtab.

"It'd be foolish to treat the Harkonnens too lightly," she said. "And you shouldn't refer to people as humans without . . ."

"Don't be so sure you know precisely where to draw the line across the spectrum," he said. "Above this point, human; below this point, animal. We carry our past with us. And, mother mine, there's a thing you do not know and should—*we* are Harkonnens."

Her mind did a terrifying thing: it blanked out as though it needed to shut off all experience.

"The Fremen have a saying they credit to Shai-hulud, Old Father Eternity," Paul said. "They say: 'You cannot clap with only one hand'. When next you find a mirror, study your face—study mine now. The traces are there if you do not blind yourself. Look at my hands, the set of my bones. And if none of this convinces you—then take only my word for it: I have walked in the future, I have looked at a record, I have seen a place, I have all the data needed to be certain."

"A . . . renegade branch of the family," she said. "That's it, isn't it? Some Harkonnen cousin who . . ."

"You're the Baron's own daughter," he said. "In his youth, the Baron sampled many pleasures, and once permitted himself to be seduced. But it was for the genetic purposes of the Bene Gesserit, by one of *you*.'

The way he said *you* struck her like a slap. But it set her mind to working and she could not deny his revelation. So many blank ends of meaning in her past now reached out and linked. The daughter the Bene Gesserits wanted . . . it wasn't to end the Atreides-Harkonnen feud, but to fix some genetic factor in their lines. *What?* She groped for an answer.

As though he saw inside her mind, Paul said: "They thought they were reaching for me. Their planning—so they believed—was to produce me. But I'm not what they expected, and I've arrived before my time. And *they* don't know it."

Jessica put a hand to her mouth.

Great Mother! He is the Kwisatz Haderach! she thought.

She felt exposed and naked before him, realizing then that he saw her with eyes from which little could be hidden. And *that,* she knew, was the basis of her fear.

"You're thinking I'm the *Kwisatz Haderach,*" he said. "Put that thought out of your mind. I am something unexpected. They reached into darkness only *thinking* they knew what was there."

I must get word out to one of the schools, she thought. *The mating index will show what has happened.*

"They won't learn about me until it's too late," he said.

She sought to divert him, said: "We'll find a place among the Fremen?"

"They have another saying, the Fremen," he said. "They say: 'Be prepared to appreciate what you meet'."

And he thought: *Among the Fremen? Certainly. You'll acquire the blue eyes, mother mine, and a callous beside your lovely nose from abrasion by the filter tube to your stillsuit; and you'll be seated more firmly than ever in spice addiction. And you'll bear my sister: St. Alia of the Knife.*

"If you're not the *Kwisatz Haderach,*" Jessica said, "what are . . ."

"You cannot possibly know," he said. "You will not believe it until you see it."

And he thought: *I am a seed.*

He suddenly saw how fertile was the ground into which he had fallen, and with this realization, the Terrible Purpose filled him—creeping through the empty place within, threatening to choke him with grief.

He had seen two branchings along the way ahead—in one he reached a point where he confronted an evil old Baron and said: "Hello, grandfather." The thought of that path and what lay along it sickened him.

The other path of the branching held long patches of gray obscurity except for peaks of violence. He had seen a warrior religion there, a fire spreading across the universe with the Atreides green and black banner waving at the head of fanatic legions drunk on spice liquor. Gurney Halleck and a few others of his father's men—a pitiful few—were among them, all marked by the hawk symbol from the shrine of his father's skull. And laced back and forth along that avenue of the future, standing like a cold goddess at many of its turnings—he had seen a sharp-eyed and stiffly proper Imperial Princess: the Princess Irulan—a stylus in one hand and a recorder lens in the other.

"I cannot go that way," he muttered. "That's what the old witches of your schools really want, though they don't see me at the heart of it."

"I don't understand you, Paul," his mother said. "What are you saying?"

But he remained silent, thinking like the seed he was, thinking with the Race Conciousness that he had first experienced as Terrible Purpose. He found that he no longer could hate the Bene Gesserits or the Harkonnens or even the Emperor. They were all caught up in the need of their race to renew its scattered inheritance, to cross and mingle and infuse their bloodlines in a great new pooling of genes. And the race knew only one sure way for this—the ancient way, the tried and certain way that rolled over everything in its path.

Surely, I cannot choose that way, he thought. But he saw again the shrine of his father's skull and the violence with the green and black banner waving in its midst.

Jessica cleared her throat, worried by his silence. "Then . . . the Fremen will accept us, give us sanctuary?"

He looked up, staring across the green-lighted tent at the inbred, patrician lines of her face. "Yes," he said. "They'll . . . call me 'Muad'Dib, The One Who Points The Way.' Yes . . . that is what they'll call me."

And he closed his eyes, thinking: *Now, my father, I can mourn you.* And he felt the tears pouring down his cheeks. ■

℞ for chaos

CHRISTOPHER ANVIL If someone came up with a useful drug that had, as its only side effect, making people more friendly and agreeable—that wouldn't be called a "bad side effect" would it . . . ?

Illustrated by John Schoenherr

Morton Hommel, Ph.D., Director of the Banner Value Drug & Vitamin Laboratories, Inc., pressed himself flat on the floor as the bullets stitched a line of holes through the laboratory wall at about waist height overhead.

A foot away, against the wall, sat a sample of the cause of the trouble, and as Hommel lay pinned from either side by his breathless assistants, he could not help seeing the label on the little bottle:

> DE-TOX
> The Antacid Detoxifier
>
> Take one to three tablets per day as required, to counteract harmful mental effects of mild over-indulgence in alcoholic beverages, sleeping pills, stimulants, stay-awake pills, nicotine, tranquilizers, etc., etc.
>
> De-Tox is a new formulation, designed to fortify the critical faculties of the human brain. Used in moderation as directed, it will overcome that groggy, fuzzy feeling that follows mild overindulgence . . .

Hommel had thrown himself under the table with the haste of a man who has only a fraction of a second to pick his spot and dive for it. Now that he was under there, he remembered the half-full carboy of sulfuric acid that was in the lab somewhere. Was it on a neighboring bench, or was it directly overhead?

He lay paralyzed, hardly able to breathe, with his heart hammering to the whine of the bullets, the clatter of breaking glass, and the smash and rattle of falling plaster. A heavy thud made the floor jump beneath him. Viola Manning clung moaning and trembling to his left arm, and Peabody, his fanatical young research chemist, kept trying to mumble the results of his latest experiments in Hommel's right ear. And all the while, scarcely a foot away, that bottle of little pale-green pills stared him in the face. The flag at the bottom of the label, and the motto underneath, seemed to jump out at him:

"A Banner Value Product of the Banner Value Drug & Vitamin Laboratories, Inc. At all better druggists, everywhere."

That, he thought, was the trouble. The stuff was all over the world, like aspirin. No, even that didn't do it justice. It was more widespread than aspirin. Any place where they ate, drank, or breathed anything that befogged their wits, there was a ready-made market for De-Tox.

Hommel experienced the fervent wish that he'd thrown the original report in the wastebasket. Or touched a match to it. Or just slid it in a drawer of his desk, ignored its possibilities, and put the men onto something else. In the beginning he could have suppressed it in any number of ways. Instead, never imagining how it would turn out, he had gone straight out to the golf course, where old Sam Banner himself instantaneously saw the commercial possibilities, and said, "O.K. Push it."

Hommel had come back with a faint professional contempt for Banner's apparently snap decision, but quickly lost that as the old man breathed fire down his neck. Meanwhile, the work unfolded like a freshman laboratory exercise, no untoward side-effects showed up, and the next thing Hommel knew, they were in production.

After that, it was a succession of new sales records, bonuses, and salary raises, plus fantastic coverage in national magazines, with Banner himself turning down honorary degrees, and trying to explain that he was a business man, not a Benefactor of Humanity. Banner solved the problem by shoving the credit off on Hommel, while Hommel, who would willingly have kept the credit, had it violently wrenched away from him by the chemist who had sent in the original report. The uproar finally died down, the new drug became a standard household item, and there was nothing to do but work the cash register, and send out friendly reminders that De-Tox was a registered trademark, and not to be referred to as "de-tox" or "detox."

It was not many months after this that Hommel, a little before noon one morning, got word to come to Sam Banner's office without delay.

Banner was seated at his desk, swirling a glass about half-full of water, and staring out the window. He glanced at Hommel.

"Something funny about these De-Tox pills."

"What do you mean?"

Banner swung his chair away from the window. "This psycho thing. They can't put the subject under after he takes the pills."

Hommel frowned. "You mean, the drug interferes with induction of the hypnotic trance?"

"Can't put them under," corrected Banner, who had a distaste for long words. "They go through all the usual stuff, and the subject won't go under. Even when they've got him trained to go under at the snap of a finger. Funny."

"Hm-m-m," said Hommel. "That *is* curious."

Banner nodded, and set down his glass. "TV sales are down."

Hommel blinked, but said nothing. If there was a connection, it would appear shortly.

Banner said, "New car sales are down. Used car sales up. Liquor sales way down. Movies are in trouble. Buying on time is down all across the board."

Hommel started. "Are you saying there's a connection between the fact that hypnotic suscept . . . er . . . that it's hard to put the subjects under, and that there's been a change in sales patterns?"

Banner nodded. "You've been tied up, Mort, so I don't know if you noticed it. But not long ago, the biggest car maker in this country came out with a campaign to put over a new style car design. For a month, anybody who used TV, radio, newspapers, magazines, or looked at a billboard was blind, deaf, and dumb from having the thing thrown at him. You know how many of this new style they've been able to unload so far? Eighteen thousand."

"That's fantastic."

"You bet it is. You study enough sales charts, and you'll see things that will stand your hair on end. People just don't react the way they used to. Not since we came out with these pills."

"But are we sure there's a connection?"

Banner tossed over a professional journal opened to an article titled, "Complex Interrelations of Social Phenomena and Waking Suggestibility."

Hommel frowned at it. It was out of his field, and the style made it abundantly plain that the article wasn't intended for the general public.

"Hm-m-m," said Hommel a few minutes later. "Well, I'm afraid I'm not familiar enough with the terminology—"

"Take a look at the footnote on page 1040, Mort."

Hommel dutifully turned pages, and read:

"Curiously enough, the proprietary preparation known as 'De-Tox' was found to affect negatively all the above-mentioned correlations. The values given are, therefore, those obtained when both experimental and control groups had refrained from the use of 'De-Tox' for a period of fourteen weeks."

Hommel hunted through the body of the article, written in a far less congenial manner than the footnote, and after a brief hard struggle, gave it up.

Banner smiled. "You have to crush all that wordage through a hydraulic press to get the meaning out of it."

"But what *does* it mean?"

"In his words, 'progressive and ordered civilization depends for its smooth functioning upon the existence, in a sizable proportion of the populace, of an extensive degree of waking suggestibility, and in some cases a mild state of hypnosis.' "

Hommel thought it over. "And he says, just incidentally, that our De-Tox cuts down this suggestibility?"

"That's it."

Hommel groaned.

"Nice, isn't it?" said Banner. "The pills are all over the world."

"Do you suppose he's right?"

Banner scowled. "That's a good question. Do you get out much, Mort?"

"Well . . . lately, since we've been working on this new hay-fever drug . . ."

"I know," said Banner. "I've been tied up lately myself. You've just been going back and forth between your office and apartment, right?"

"That's pretty close to it."

"Read the papers?"

"Just the headlines."

Banner tossed over a folded newspaper. "Take a look at the car ad on the back page."

Hommel turned the page over, and read:

Quality, Comfort, Durability

Abelson's presents the first choice of long-lasting motor vehicles. The price is low but the value is high. Every interior is cleaned, all fittings tightened, and all moving parts lubricated. Why pay $4,000.00 and up for "newness"? Who cares if the fenders sweep up, out, or down? What's a little rust? A car is transportation. Who cares if the style is boxy, stretched-out, flattened, or flaring? Let's be frank; Do you want to buy a new car and look like a fool to the neighbors?

Drop in at Abelson's Used Car Lot and see our selections of best buys from the best years.

You'll be glad you did.

Hommel looked at the picture above the advertising message. The picture showed an exaggeratedly modern-looking car, with a grille like two rows of teeth, and the

ends of four bills, each labeled $1,000, sticking out between the teeth.

He read the ad over and over again, and one line stood out:

"Let's be frank: Do you want to buy a new car and look like a fool to the neighbors?"

Hommel scratched his head. "I certainly seem to have missed *something*."

Banner glanced at his watch. "Let's go into town for lunch. We can circulate around a little, and look things over."

Banner Laboratories was located well out of town, so it was after noon when they got there, and the best eating places were crowded.

Banner said, "If you can hold out for an hour or so, Mort, it might be a good idea to just look around."

"Suits me."

Banner parked the car, and they got out, across the street from a large new-car showroom. The big window was plastered with bright stickers, and the face of the building was hung with pennants and streamers.

Hommel felt the usual quickening of his pulse as he and Banner approached the door. They stepped in, to be assaulted by a glitter of polished metal, a fresh new-rubber smell, and the impressive sight of a brand-new car slowly revolving on a turntable.

Across the room, four or five salesmen sat hunched around a table, their ties loosened, coats hanging over the backs of their chairs, and smoldering cigarettes drooping out of the corners of their mouths as they played a listless game of pinochle.

The door clicked and banged shut.

The salesmen looked around, blinking. There was one swift complex movement, a monetary waving of arms, sawing of elbows, scraping of chairs, and a salesman, exhaling a cloud of smoke but with no cigarette in sight, came neatly, briskly, across the floor toward them. His step was confident, and his manner friendly, but his eyes suggested a boxer who had been thrown three times by a judo expert, and is coming out for the fourth time.

"Good afternoon, gentlemen. You want to look at a *new car?*"

Banner nodded.

"Well, sir, we've cut the price on this model to $2,895.00. For your money, you get something no used-car dealer can offer—newness. The style, of course, is a little different from past years. But what is style but *proof of newness?*"

He maneuvered them around to a sleek, dark-blue model, and opened the door to show a lush, expensive interior.

"Granted," he said, "it's a little extreme, but . . . ah . . . look how new the upholstery is! Look at the floor mats, and the brake pedal—"

Banner, obviously patterning his reaction after the advertisement they'd read earlier, shrugged. "Who cares about the upholstery?"

"Ah, sir, but remember, it's more *proof of newness!* Of course, what counts in a car is the running gear. But one of the most important factors in the condition of the running gear is its freeness from wear and misuse. It's *newness*, in other words. And you'll find no newer car anywhere than—"

Banner peered inside.

"Fantastic dash. Everyone will laugh like—"

"A car, sir," said the salesman quickly, "is a long-term investment. Would you permit uninformed neighbors to decide your choice of stocks and bonds? Of course not! Why, then—"

Like two fencers, Banner and the salesman thrust and parried in a rapid exchange of arguments that lasted five minutes, with the other salesmen listening breathlessly, and the owner wide-eyed in a glassed-in cubicle to one side. At the end, Banner conceded that he hadn't heard such good reasons for a new car in years, but he still wanted to look around. The salesman handed over his card, and managed to shake hands with both of them on the way out, while telling them how welcome they'd be when they came back.

As the door swung shut, a voice could be heard in the background, saying, "We've got to tone that dash down *somehow*."

Banner and Hommel glanced at each other after they'd gone a few steps.

"If," said Banner, "*that* salesman can't sell new cars, who could?"

Hommel said uneasily, "How do we know where a thing like this is going to stop?"

"That's the trouble. We don't."

They walked on in silence. Then Banner cleared his throat.

"Look there. Down on the next block."

Hommel glanced at a huge sign:

BEST YEARS—BEST BUYS

Twenty or thirty customers were unhurriedly making their way through a large used-car lot. Here and there, attendants were polishing and waxing cars. Salesmen were raising hoods, and helpfully taking off brake drums so customers could see the condition of the brake lining.

As Hommel and Banner walked past the car lot, Hommel became conscious of some odd quality about the appearance of the customers. "They look—" he hesitated.

"Neat," said Banner, frowning, "but shabby?"

"I think that's it."

Hommel studied a middle-aged man by a nearby car. He was wearing a clean, frayed, black sweater with three yellow stripes on the sleeve and a big yellow "W" on the back. He was saying expansively to a salesman, "So the wife says, 'Charles, you can't wear that old thing. What will people think?' And I said, 'This sweater's as warm as a new one. They'll think I've got sense, what *would* they think?' " He shook a little greenish object out of the bottle, shot it into his mouth, crunched it up, and offered the bottle to the salesman.

"Don't mind if I do," said the salesman. He shook the bottle over his open hand, tossed a little pale-green pill into his mouth, chewed contentedly, and handed back the bottle. The word "De-Tox" was momentarily visible on the label. The customer slipped the bottle in a side pocket. The two men chewed placidly.

Hommel and Banner stared.

"Ah," said the customer, "that old stuff really knocks the horrors in the head, doesn't it?"

"Good stuff," agreed the salesman.

"So they drop the bomb—" said the customer.

"Sure. So what? You're no deader than if a truck hit you."

"How much you want for this clunker?"

"Nine hundred. Good tires, good battery. The engine's smooth. Standard transmission, so you got no worry there. Heater. Radio. If you listen to that junk anyway."

"I used to listen to the news. But why bother?"

"Sure. What happens, happens."

"So the Arabs *are* mad at each other. What can I do about that? How's she start?"

"Fast. We take care of that."

"Jack her up. Let's jerk a wheel off to begin with."

"Yes, *sir*."

As the customer bent over to examine a tire, the neck of the pill bottle thrust out of his pocket.

Banner tore his gaze away with an effort.

Hommel let his breath out with a hiss.

They walked on, feeling stupefied, and caught sight of a "Bar and Grille" sign down the street.

"Let's go in there and eat," said Banner. "I want to sit down and think this over."

"It will certainly bear thought," said Hommel. "Did you see how casually they shook out those pills?"

" 'Really knocks the horrors in the head,' " quoted Banner. "What was it he called them?"

" 'That old stuff,' " said Hommel.

"It sounds like some kind of liquor. Of course, it could be that that was just an exception."

Hommel was feeling more and more sure of it as they put the car lot farther behind them. "After all," he said, "some people chew garlic—"

Banner put his hand on Hommel's arm.

Hommel looked around.

Coming out of the doorway of the bar was a man with ruddy complexion and bloodshot eyes. He pressed his hand to his mouth, tilted his head back, and chewed with a solid crunching noise. With his other hand, he held onto the doorpost. "Ah," he murmured, swallowing repeatedly, "that licks it." He reeled out onto the sidewalk, tilted expertly, banged into the building, and walked along with his feet tilted out and hands moving along the brick face of the building as if it were on wheels and he was shoving it to the rear. As he came closer, he saw Hommel and Banner, and muttered, " 'M all right. Don't worry. M' body's drunk, but my head's cold sober."

An aproned figure appeared in the doorway. "You take those pills, Fred?"

"Sure, sure. You think I want to get run over or something?"

He reeled out past a storefront with a plate-glass window, staggered over to a door leading to a flight of stairs, expertly grabbed the handle on the third try, tilted forward, and vanished inside.

The bartender mopped his brow with a big handkerchief, and went back into the bar.

Two men in their early twenties came out, absently tossing pale green pills in their mouths, and strolled off down the street.

Hommel looked in the doorway, and saw, beside the cash register, a glass dish of pale-green pills with a cardboard sign, rudely lettered:

"Dettox. Take Some."

Banner glanced in over his shoulder. "Let's eat some place else."

Hommel looked down the street. On the corner at the far end of the block, a sign read, "Soda-Pharmacy-Lunch."

Hommel pointed. "How about that?"

"Fine. A sandwich is all I want."

They walked in silence for a moment, then Banner said, "This thing is a lot more widespread than I imagined."

"We might *still* be getting an exaggerated picture of it."

"Maybe. But it's one of those things you can discount by fifty per cent, and *still* have too much."

They pushed open the door of the drugstore, sat down at the lunch counter, and ordered ham sandwiches and milk shakes. Hommel gradually relaxed, and was moodily contemplating his sallow and unsatisfactory image in the drugstore mirror across from the counter, when he felt Banner grip his arm. He turned, and Banner murmured, "Look at that boy and girl."

Seated at a table between the soda fountain and a display of alarm clocks were a boy and girl with glasses of some kind of dark-brown carbonated drink. The boy raised his eyebrows at the girl, who giggled as he solemnly dropped two pale-green pills, one in his drink, one in hers. To the accompaniment of a violent effervescence, they crushed the pills with their spoons.

Hommel was momentarily paralyzed. Then he glanced around, horrified that no one was doing anything to stop them.

At the soda fountain, a boy in a light-brown jacket was turned away, just taking two milk shakes from the mixers. At the prescription counter at the far end of the room, a man in a white jacket was handing a woman a package, and smiling at her owlishly through thick lenses. He raised one finger of each hand.

"*One* for *one*. You'll be tranquil, but not dopey." He laughed. "No, madam, they won't fight each other." He turned to the next customer. "Yes, ma'am?"

Hommel let his breath whistle out through his teeth. The boy and girl had set down their empty glasses, and were now watching each other expectantly.

For an instant, they both straightened with a look of mutual disapproval. Then a kind of greenish light came into the boy's eyes. The skin at the corners of his eyes tightened up as his ears pulled back. He opened his mouth and made a "*whooo*" sound, as if blowing out live flames.

Arm in arm, the boy and girl went out the door.

Hommel stared after them. "Great, leaping—"

Banner growled, "That boob at the prescription counter is packaging De-Tox with the tranquilizers."

Hommel started to get up.

Banner gripped his arm. "Hold on. You stop a fan by pulling out the plug, not grabbing the blade."

Another customer was approaching the drug counter. Another large bottle of De-Tox was wrapped up and handed over. The cash register jingled merrily. Another customer stepped up.

"I see what you mean," said Hommel slowly.

Just then, the boy behind the lunch counter set down their milk shakes and sandwiches. They ate somberly, then started back to the plant. On the way, they stopped for gas, and were treated to the sight of a yawning truck driver swallowing a pill to keep awake, and following it with two pale-green De-Tox pills.

Banner and Hommel pulled through the gates of the Banner Value Drug & Vitamin Laboratories, Inc., in silence and a state of profound gloom.

The next six weeks passed with Hommel running a big program to search out the effects of chronic overdosing with the pills, and, if possible, to find some antidote. While Hommel suffered from the gradual discovery that half his research staff was doped to the ears, Banner piled up frustrations trying to get official recognition of the possible dangers of the drug.

"*Phew!*" said Banner. "How do you convince them when they're already on the pills themselves, with their critical sense working overtime? It was all I could do to get the drug barred from the armed forces. One of the boobs even told me I should 'take medication to quiet an excessively active imagination.' "

"What I've run into is just as bad," said Hommel. He opened a portfolio, pushed some bulky reports out of the way, and pulled out a folder of large glossy photographs.

"We've found out what chronic overdosing with the drug does. Here, for instance, we have a dog massively doped with the pills."

Banner leaned forward, and the two men looked at a photograph of a large lean dog inside a square, fenced-in pen, with the fence completely removed from the side behind the dog. The dog was looking hungrily through the woven wire at a bowl of what appeared to be big chunks of meat covered with gravy."

"Hm-m-m," said Banner. "All he has to do is to go back through the open side of the pen, go around the other side, and he's got the meat."

"His approach was different," said Hommel, and handed over another picture.

This photograph showed large and small stones, gravel, and dirt thrown back from the fence, a shallow hole dug under the fence, clumps of fur sticking to the bottom wires of the fence, and the dog, scratched up and exhausted, bolting down the food.

Banner stared. "Is this what it does to people?"

"Well, here are some first-rate chess players, who originally got started on the pills because they wanted to be clear-headed during a tournament."

The photograph showed half-a-dozen intellectual-looking individuals peering over each other's shoulders at a chessboard, where a White Pawn sat on Queen's Knight 2, with the White King right beside it on QB2. Arrayed against White was the Black King on QB4, Rook on K4, Queen on K8, and Knight on QKt6.

"Whose move?" said Banner.

"Black's. Now, all that these doped-up chess players had to do was to find a good move. Three of them favored K-QB5. That's stalemate. One liked Q-Q7ch. That loses the Knight. Another favored R-K7ch; that's another way to lose the Knight. The last one got excited and figured he had checkmate. He moved Q-B6ch. White has four different ways to get out of check, including a choice of two ways to take the Queen."

Banner passed his hand over his face.

Hommel pulled out a photograph of three mechanics squinting under a raised hood. The engine showed up clearly, Hommel said, "Look at that distributor."

"Hm-m-m. The high-tension wire from the coil is interchanged with one of the spark-plug wires. They're plugged into the wrong connections on the distributor cap."

"Right. These expert mechanics figured it out, too—in an hour and forty-seven minutes."

Banner shook his head. "What's that next one?"

"A highly-competent chemist who used the pills to improve his objectivity, and was so pleased with the effect that he gradually increased the dosage."

The photograph showed a man in a laboratory jacket holding a dripping Bunsen burner by the base. Before him was a distilling flask fitted with upright reflux condenser. A length of rubber tubing supplied water to the top of the condenser's water jacket. This water ran down through the water jacket, and was carried off by another length of rubber tubing, which coiled around and connected to the side-arm delivery tube on the distilling flask. Everything was thus neatly connected up, including the pointless side arm. The water from the jacket obediently flowed in through the side arm, filled up the distilling flask, rose up through the inside of the condenser, overflowed at the top, like a fountain, and poured down the outside.

"Ye gods," said Banner, "surely he could figure *that* out!"

"I think he secretly thought he was witnessing the spontaneous generation of matter."

"But how does this come about? The drug starts off by *stimulating* the critical faculty."

"Yes, and following repeated overstimulation comes fatigue, exhaustion, and malfunction. Eventually, people get into such bad shape from overdose of the pills that if they stay off them for a while and start to recover, the first flickers of returning intelligence strike them as 'weird ideas,' instability, and so on. They're afraid that they're getting 'strange.' So, they take more pills."

Banner shook his head. "What's that next picture?"

Hommel handed him a photograph of three keen-eyed men, one gnawing the end of a lead pencil, and all studying a circuit mounted on a board.

Banner said, "What's the difficulty?"

"It doesn't work."

Hommel watched Banner's face change expression as his gaze shifted from one part of the picture to another.

"Where's the power supply?" said Banner.

Hommel laughed dryly. "They overlooked that."

Banner shook his head and turned away, to gaze out the window. "This thing has got to be stopped. If we were the only people making the drug, we could shut down our plant to stop it." He banged his fist into his hand. "What we need is some kind of dramatic incident, to jolt people to their senses! But what—"

A pill-colored, pale-green sound truck went by off beyond the fence, on the road that paralleled Banner Drugs' main building. Pale-green pennants whipped from poles mounted on the fenders and at the corners of the truck's roof. Banner and Hommel followed it with their eyes as it passed, reading the big sign on the side:

8:00 p.m. Tonight
THE
SOLID
PHALANX
Be at the Stadium to hear Big Jim!

They stared after the truck as it disappeared down the road.

"What," said Banner, "is The Solid Phalanx?"

Hommel scowled. "I've heard our men talk about it. It's apparently a pseudo-Nazi organization of dead-end pill-addicts looking for someone to blame. 'Big Jim,' I think, serves as imitation Fuhrer, and blames all the troubles in the world on 'eggheads.' The last I heard, his supporters were supposed to get guns and ammunition, and be ready for The Day."

"What happens then?"

Hommel shrugged. "I don't know."

"Hm-m-m," said Banner. "8:00 p.m., in the stadium. Pill addicts." He glanced thoughtfully at Hommel. "Mort, could you make up a few bottles of imitation pills? The same color, size, shape, and flavor—but without the drug?"

"Ye-s," said Hommel, "but—"

"It might pay us to find out more about Big Jim."

Eight o'clock that night found Banner and Hommel getting out of their car in a big parking lot, bottles of fake pills clinking in their pockets. They made their way with a stolid mass of dour-faced people, past black-uniformed guards wearing black leather belts, black boots, and black-and-white armbands, and who relieved them of fifty cents apiece, into a stadium full of silent people, whose only visible movements consisted of breathing, tossing pills into their mouths, chewing, and swallowing. The only perceptible sounds in the stadium were the moaning of the wind, and a continuous low crunching noise, like twenty or thirty cars rolling slowly downhill on a gravel road with their engines off.

The dour faces and endless working of jaws began to get Hommel after a while. He could feel himself starting to get a little choked. His hand wasn't quite steady as he tossed fake pills in his mouth. His stomach muscles twitched in incipient spasms. The effort to keep his face straight was becoming a struggle.

All around him, the *munch-munch* sound went on endlessly.

Hommel could feel the irresistible burst of laughter build up. Desperately, he told himself what the consequence of that would be.

Munch—munch—munch—munch—

Just as his self-control neared the snapping point, there was a movement down below. Instantaneously, everyone around Hommel, including Banner, only a fraction of a second late, sprang to their feet.

What happened was a little hard for Hommel to follow, because he was still struggling not to laugh. Between sudden shouted roars of approval, that ended just as abruptly, he could hear a voice shout:

"Who made the first gun?"

The crowd roared, "Eggheads!"

The voice shouted, "Who made the first plane?"

"Eggheads!" roared the crowd.

"Who made the first bomb?"

"Eggheads!"

The *munch—munch—munch* was clearly audible in the pause between shouts, and Hommel, gagging and straining, was only vaguely conscious of the progression through poison gas, germ bombs, intercontinental missiles, and radioactive fallout, which led to the comparison of murderers and eggheads, which in turn brought up the question of punishment, and "execution of The Plan."

By this time, Hommel had himself in hand again, heard the rousing unified scream of "Death to the Murderers!" and something in the atmosphere of the place got across to him so that he had no further temptation to laugh.

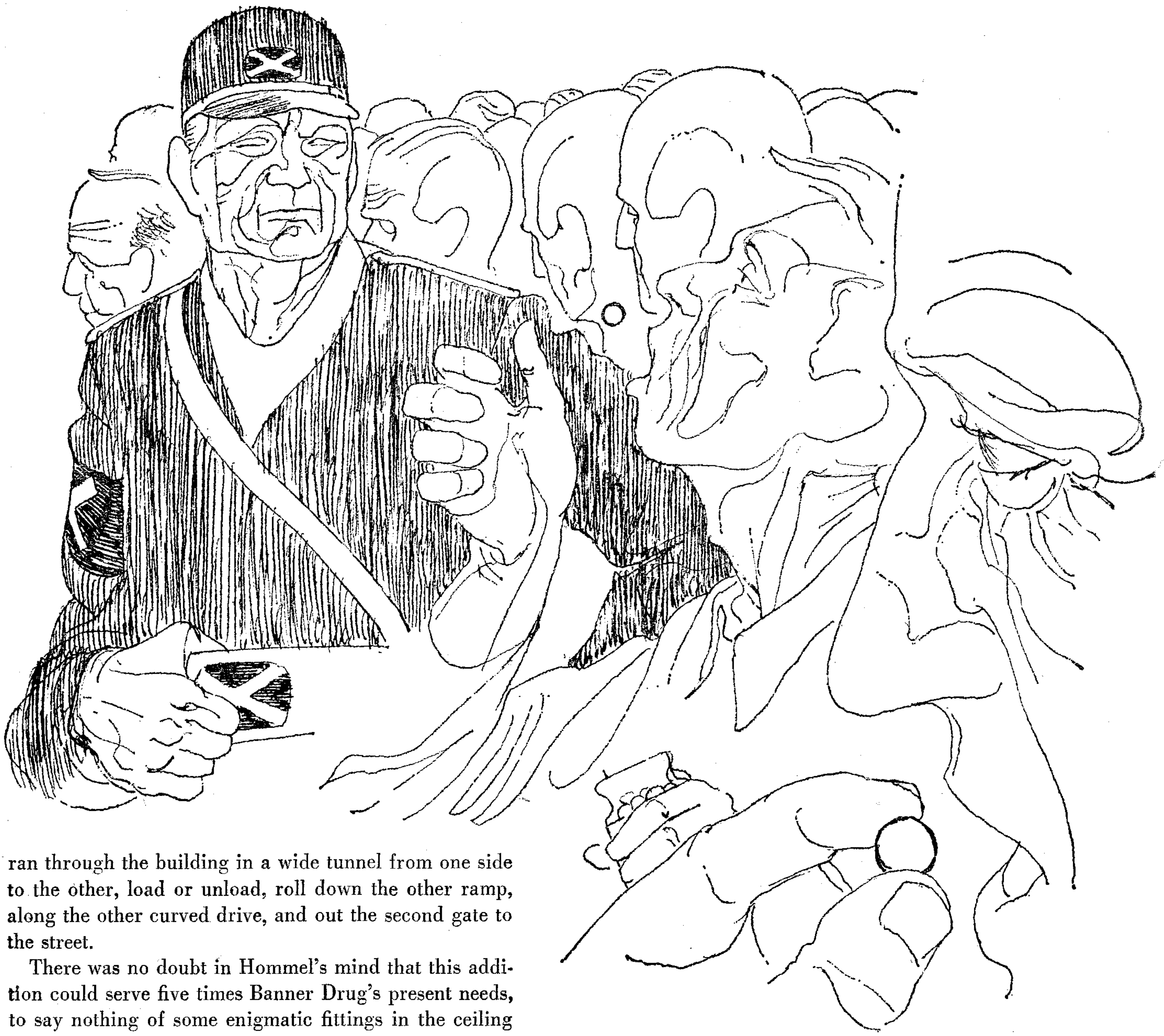
"Big Jim" now finished up with the command to buy more guns and ammunition, and announced that armbands would be distributed on the way out.

Hommel and Banner found themselves sitting in the car a little later, holding black armbands marked with a large "X," which symbolized what The Solid Phalanx was supposed to do to all eggheads at no very distant date.

Hommel had expected Banner to be worn out by all this grimness and activity, but as the old man contemplated the armband, he gave a smile that Hommel would have hated to have inspired, and was cheerful all the way back to the plant. Hommel couldn't get a word of explanation out of him.

Next day, ground was broken for an addition that reached at right angles all the way from the main building to the front fence bordering the road. This addition, seen from above, formed an upright to the long crossbar of the main building, to make a sort of massive T, the lower end of the upright of the T toward the road, and the crossbar parallel with the road and well back from it.

The new addition was wide and deep, massively built, with a broad ramp that led up on either side to a huge loading deck, so that trucks could drive in one electrically-controlled gate in the extra-heavy fence, roll along the curved drive, up the ramp onto the loading deck that



ran through the building in a wide tunnel from one side to the other, load or unload, roll down the other ramp, along the other curved drive, and out the second gate to the street.

There was no doubt in Hommel's mind that this addition could serve five times Banner Drug's present needs, to say nothing of some enigmatic fittings in the ceiling of the loading tunnel, that could serve no useful function Hommel could think of.

Hommel, however, had no time to ponder this. It was at this point, with the Phalanx growing daily more formidable, and with a monster rally scheduled for early the next afternoon, that Banner chose to appear on a TV program and remark that Banner Drugs appeared very close to having an antidote to the De-Tox pills.

This was news to Hommel, whose effective research staff was reduced to himself, Viola Manning, and young Peabody. Worse yet, it dawned on Hommel that the people behind the Phalanx would not take kindly to this mythical antidote that would cut their following out from under them. But Banner didn't stop there. When asked about the Phalanx, he referred to them offhand as "a mass of addled brains. I hope we can cure them soon." "Big Jim" got passing mention as "that vulture." Banner finished the interview with the remark that, "I hope we can collapse the Phalanx bubble sooner than anyone expects."

The next day, the big parking lot at Banner Drug was all but empty, as frightened employees stayed away.

Shortly after time for the Phalanx's monster rally, a long line of cars stopped along the road outside the gates, and a crowd of men with black-and-white armbands climbed out carrying guns, and headed for the fence. To Hommel's horror, someone threw the switch that opened the electrically-controlled gates. The mob poured through, spread out, and swarmed toward the main building, directly in front of them.

Hommel, lying under the table, with Viola Manning clinging to his left arm, and Peabody muttering something about pills in his right ear, was just living from moment to moment. It was obvious to him that Banner's foolhardy actions had doomed them all. He felt a monetary pity for the old man, at this moment cowering, no doubt, in his office.

An electrically-amplified voice, unmistakably that of

Banner, boomed out over the din. With a kind of pitying contempt, it demanded:

"What's wrong, you poor boobs, can't you find us? Afraid of eggheads? *Come on!* Let's see if you're yellow!"

The volume of fire that answered this left Hommel all but deaf. But after the first few moments, not a shot came into the room. Hommel's curiosity got the better of his judgment, he pulled loose from Viola and Peabody, stood up in a half-crouch, and peered out the window.

Gun-carrying figures wearing armbands ran past outside.

Banner's amplified voice rose over the din:

"You want to fight, do you? O.K. *Here we come!*"

A host of armbanded figures sprinted toward the sound of the voice.

The building trembled continuously.

Peabody's lips were moving, and Viola had both hands pressed to her ears, her face contorted.

It made no difference. All Hommel could hear was one continuous crash and roar, that left him dazed and unconscious of the passing of time.

Finally it came to Hommel that the noise was dying down.

Someone tapped Hommel on the arm. He looked around.

Banner, an old but efficient-looking Springfield .30-06 in one hand, and a bandolier of ammunition slung across his shoulder, jerked his head toward the door. Dazedly, Hommel followed him outside.

When they were a few yards from the door, Hommel came to his senses. "Listen . . . *that mob might—*"

"Not for a while."

Hommel followed Banner's gaze toward the massive new addition. Its walls were pitted and pockmarked all over. There was scarcely a sliver of glass left in a window from one end of it to the other. The ramp was littered with knots of men, their eyes streaming, blindly hammering at each other with gun butts, breaking apart to reel over the edge of the ramp, and fall flat in the dirt. A multitude of struggling figures could be vaguely seen through the grayish haze that drifted out the entrance of the loading deck.

Hommel stared. *"Who are they fighting?"*

"Who do you think? They're drugged. That addition splits the ground here into two parts, with a gate on either side. They came in through both gates, ended up on both sides of the addition, went into a rage when I spoke through the loud-speakers that are under the roof on both sides of the addition, and fired at the building from opposite sides. Some of the shots sprayed through that cloud of tear gas in the loading tunnel, they charged in, couldn't see who they were fighting—"

"They're fighting *each other?"*

Banner nodded with satisfaction. "At their own cost, they're making a nice big mess that can't be ignored." He glanced around. "Look there."

Way out by the far end of the fence, wary reporters and cameramen could be seen coming forward very cautiously.

Banner took one last satisfied look at the struggling, retching, helpless tangle, and opened the door. "Once word of this mess reaches the majority of people who use only a mild overdose of the drug, they'll drop it like a—"

Peabody, on the way out, all but knocked them down in his haste.

Somewhere, there was the blast of a whistle. Hommel glanced around, to see heavily-armed troops, well spread out, coming across the open ground to the south.

With a sensation of relief, Hommel knew the mess *was* coming to a close. He remembered Banner's remark that he had barely gotten the drug barred from the armed forces. By that narrow margin, they should be able to get through the final convulsions. Then the thing would be over. Hommel promised himself that if ever again some wonderful new drug should appear—

Vaguely, he became conscious that Peabody was earnestly talking to Banner. Peabody had been trying to tell Hommel something earlier. Hommel, thoroughly skeptical of the unpromising sidetrack Peabody had insisted on following, now listened curiously.

". . . And *then* tried the methyl ether, instead," said Peabody, happily holding up a little, pale-pink pill. "I was hoping to get the antidote, but Dr. Hommel was right. It isn't that. But there *is* a mental effect. This acts to *stimulate visual memory.*"

Viola Manning shut her eyes.

Hommel gripped the doorframe.

"H'm-m-m," said Banner, eying the pill.

Peabody said, "I tried it first on rats learning a maze. The effect was unmistakable. I tried it on myself, and I could see almost any page of my college organic text, just as if I were holding it in front of me. The effect lasted almost four hours. Sir, it could be tremendously useful. Students, engineers, doctors—"

Earnestly, Hommel stepped forward to protest—and then paused.

He always *had* wanted a good visual memory.

Banner was saying thoughtfully, "Not quite as big a market as . . . er . . . some we've had, but still—"

The three men huddled around the little pale-pink pill, looking at it as Eve may have looked at the apple.

There was a slight commotion, and they glanced around.

Viola had passed out cold.

Peabody went for water.

"Women," said Hommel, "are illogical."

"True," said Banner, "but why so, particularly?"

"Well, she came through all that trouble. She didn't faint *then.*"

Banner nodded. "I see your point."

They glanced back at the new pill.

"She only faints *now*, when there's nothing to be afraid of." ■

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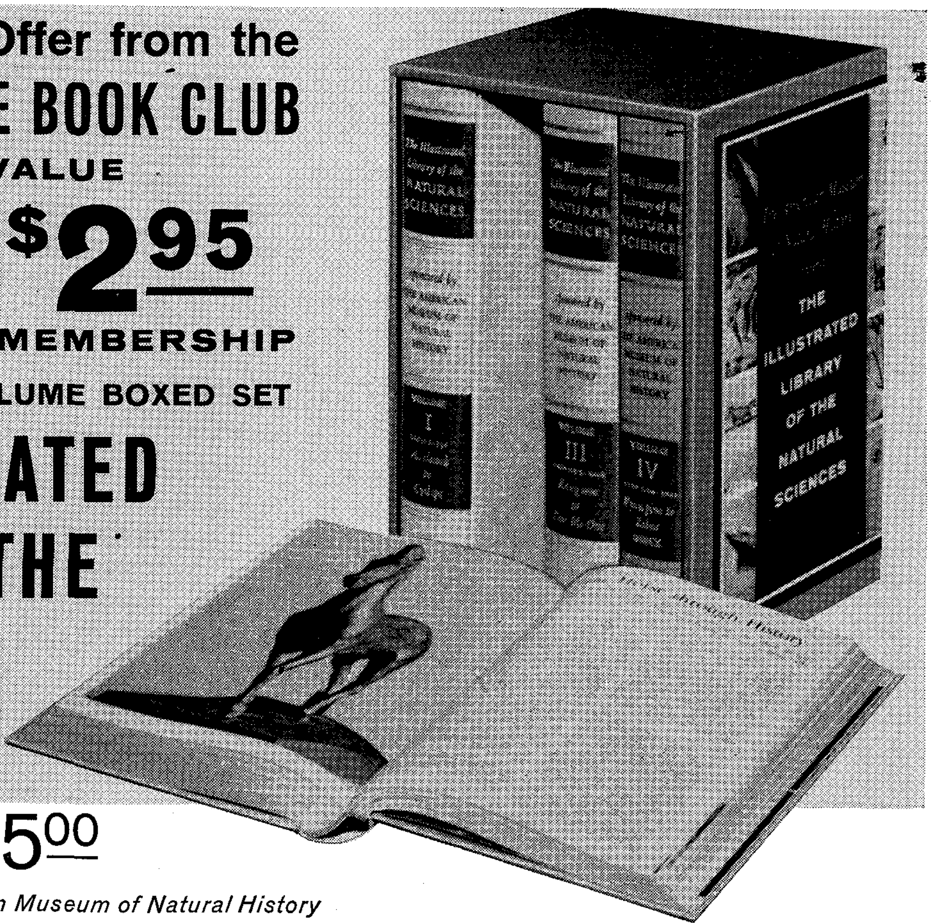
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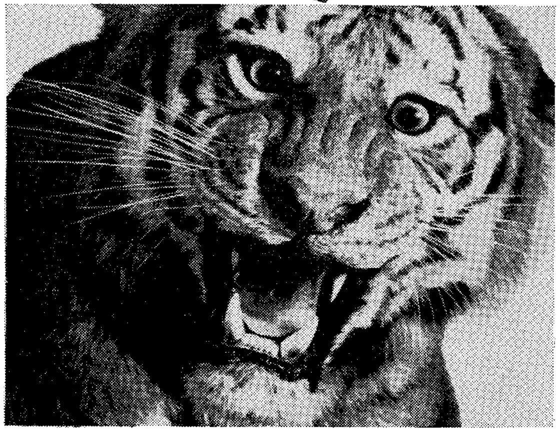
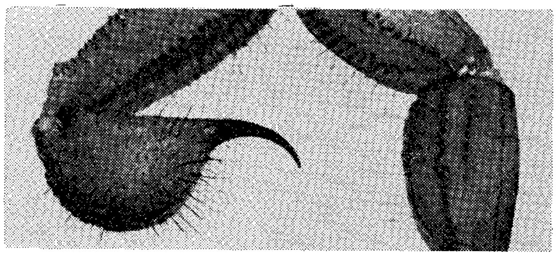


This magnificent tiger makes his home not in the jungle, but in the snowy wastes of Siberia.

Shrews are the smallest—and by far the most pugnacious—of all mammals. This African species is an excellent jumper.



Not a cactus plant, but the jointed hind portion of a Giant Hairy Scorpion, showing the stinger projecting from its bulbous base.

SECONDARY METEORITES

continued from page 16

stances had a concurrent origin is like trying to convince someone that a full grown man was born from the forehead of his father.

As for the asteroid planet origin of all meteorites, that would require some revision of the solar system timetable to account for the carbohydrates, whereas this third theory supports it.

The full discussion of any theory is hampered in that there are many blank phases in the available information. We know that the octahedrites have absorbed 2.5 to 38 volumes of gases, but no one has analyzed these gases to the extent that they can tell us about the percentages or argon, crypton, xenon. If it can be proved that they are contained in these absorbed gases, it would explain the increase in the rare gas content of the secondary meteorites.

An unsettled question is why coesite and stishovite have not yet been found in meteorites since they are evident wherever quartz has been subjected to severe shock. Coesite, at least, is sensitive to catalytic action. These minerals are rarely present in tecktites which are thought to be glass formed at the site of meteoric blasts. Apparently, wherever glass is formed in the presence of molten and vapor nickel-iron, coesite and stishovite are not readily formed.

The presence of the glass explains the lack of quartz in meteorites. Since quartz is an extremely abundant mineral on the face of the Earth, one is apt to wonder why it is practically absent in meteorites. Quartz plus metal oxides makes glass when treated at a high temperature. This is in effect how meteoric glass evolves.

The isotropic distribution of carbon in certain meteorites has been unbalanced, but again, we do not know the isotropic distribution of carbon in octahedrites. So there is another equation we must leave in limbo.

All theories have unsettled portions that leave room for doubt. In this case we must wait on certain information to be forthcoming. In the meantime we must pursue the truth by persistently working on the problems. Naturally, each investigator tends to study the problem of his own theory. Sometimes a critical experiment will be invisioned to displace other contenders for the field. This theory must await its turn.

Experimental Meteorics

Experimental meteorics is rather difficult because of the extreme laboratory conditions required to reproduce the circumstances of meteoric genesis. But, some work has been done.

In 1953 coesite was first synthesized by Coes in the laboratory by heating a mixture of metasilicate and diammonium phosphate to temperatures between 500° and 800° at a pressure of 35,000 atmospheres for fifteen hours. The similarity of the temperatures and pressures of the laboratory with the conditions surrounding meteorite impacts led Choa, Shoemaker and Madsen to discover coesite at the Barringer Crater in 1960. Now this polymorph of silica is considered to be pathognomic of an astrobleme or meteoric crater.

Likewise, Stishov, a Russian, in 1961 synthesized stishovite at 1200–1400° and 160 thousand atmospheres. This again is a polymer of silica with a composition of $Si0_2$. Report of this sent Choa scrambling back to Barringer Crater to find this substance in nature in 1962.

Another experiment closer to the point was reported in June 1963 by Fredriksson and Ringwood. They prepared a synthetic mixture similar in composition to the silicate portion of the Bjurbole chondrite by grinding together magnesium olivine, fayalite, enstatite and oligoclase in the required proportions with 1% water. This mixture was placed in sealed platinum tubes and heated by induction to approximately 1500° C. At this temperature the tubes burst and injected their contents into a cool alundum cup. The cool cup quenched the superheated ejecta of the platinum tubes in a matter of seconds. The recovered spheres had diameters ranging between 0.75 to 0.95 millimeters. This diameter is related to the surface tension of the molten glass.

These synthetic chondrules had an internal composition of olivine, pyroxine, and glass showing a general resemblance to some natural meteorite.

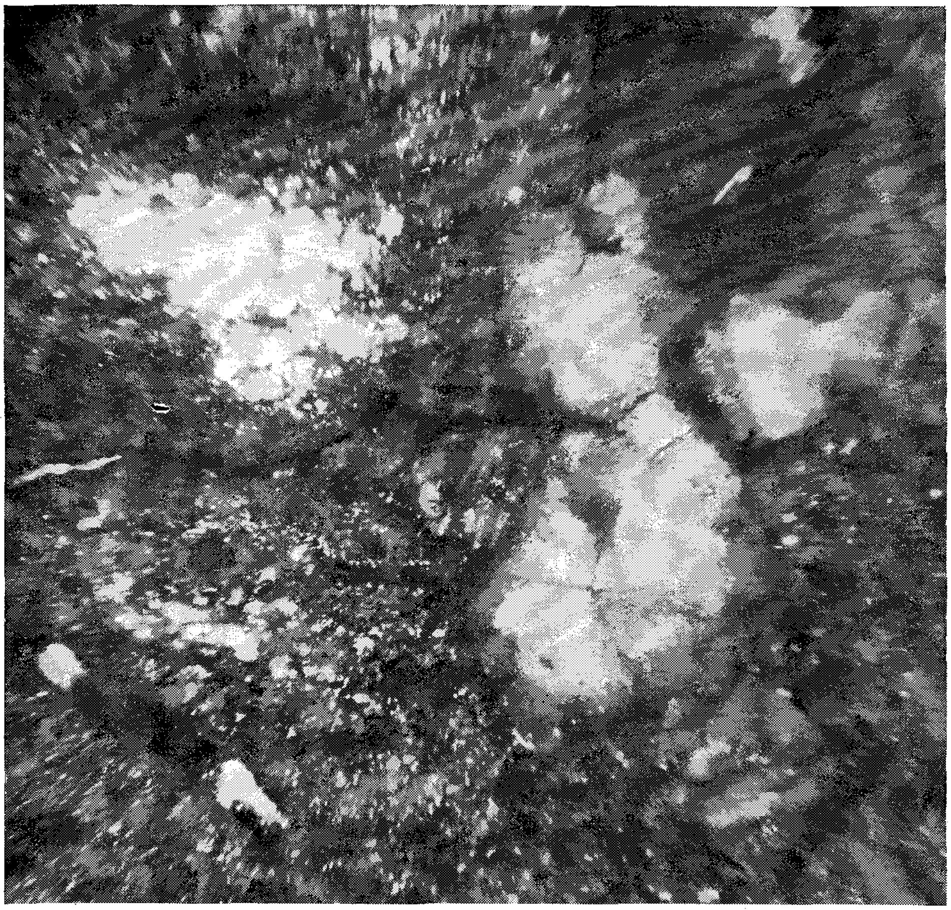
From this experiment they concluded that the chondrites must be from some flaming, volatilizing, explosive situation in which the chondrules were cooled in a matter of minutes rather than seconds. The obvious similarity of these conditions with those recommended in this paper is significant.

In another experiment two wafers were made of gabro which is a granular igneous rock, essentially plagioclase feldspar rich in lime. These wafers were shock-loaded at 4.5 km/sec to 275 and 700 kilobars pressure respectively. Temperatures in the lower one reached 250° C. and in the higher one reached 1900° C. In the lower pressure wafer an achondritic solid-to-solid low temperature reaction took place. The section revealed a maskelynite formation, that is, an amorphous glass formed from plagioclase with shattered and reshattered fragments of plagioclase in the matrix. Milton and DeCarli felt that this reshattered condition was due to reflected shock waves. The net result was a verisimilitude to the Shergotty meteorite; that is, a eucrite seen to fall in India in 1865. Nickel-iron is found only in trace amounts in this type of chondrules.

The high pressure wafer yielded a chondritic type of result with swirls and spherules in its structure. One of the major points of the investigation is that when we are dealing with intense shock waves we have to think easily of exotic types of reactions, such as, low temperature solid to solid, and solid through solid. Just as the magician can whip the tablecloth from under the china, if you hit one solid by another moving fast enough, both morphologies may occupy the same space without major disturbance to the structures of either; viz.: Varamin. When we get shock velocities nearer

Goalpara, India, found 1868, weighing six pounds. This was amongst other specimens sent by the Rajah of Goalpara to the Calcutta Museum. It consists of olivine and pigeonite with nickel-iron. Of particular interest is the presence of stress fracture patterns very similar to those in the sheared Coconino sandstone from Meteor Crater, Arizona. Another coincidence is the carbonado diamonds found imbedded in graphite in both Goalpara and the Arizona Meteorite. The possibility that Goalpara might be secondary to the Arizona impact is an open question.

Breitenbach, Erzgebirge, Saxony, was found in 1724. This meteorite is a siderophyre, the only one in its class closely related to the mesosiderites. There are five fragments totaling 7,731 gms. It consists of a network of nickel-iron enclosing fractured fragments of orthopyroxene and some tridymite. The Widmanstatten structure is pronounced, therefore, it is presently classified as a primary. Since tridymite indicates that the meteorite had been heated to 800° C. or more, and since tridymite is not stable above 3,000 kg/cm^2 pressure at any temperature, its presence in this meteorite places severe restrictions on its conditions of crystallization. It might indicate that this meteorite is a secondary from a hot planet such as Mercury or Venus.



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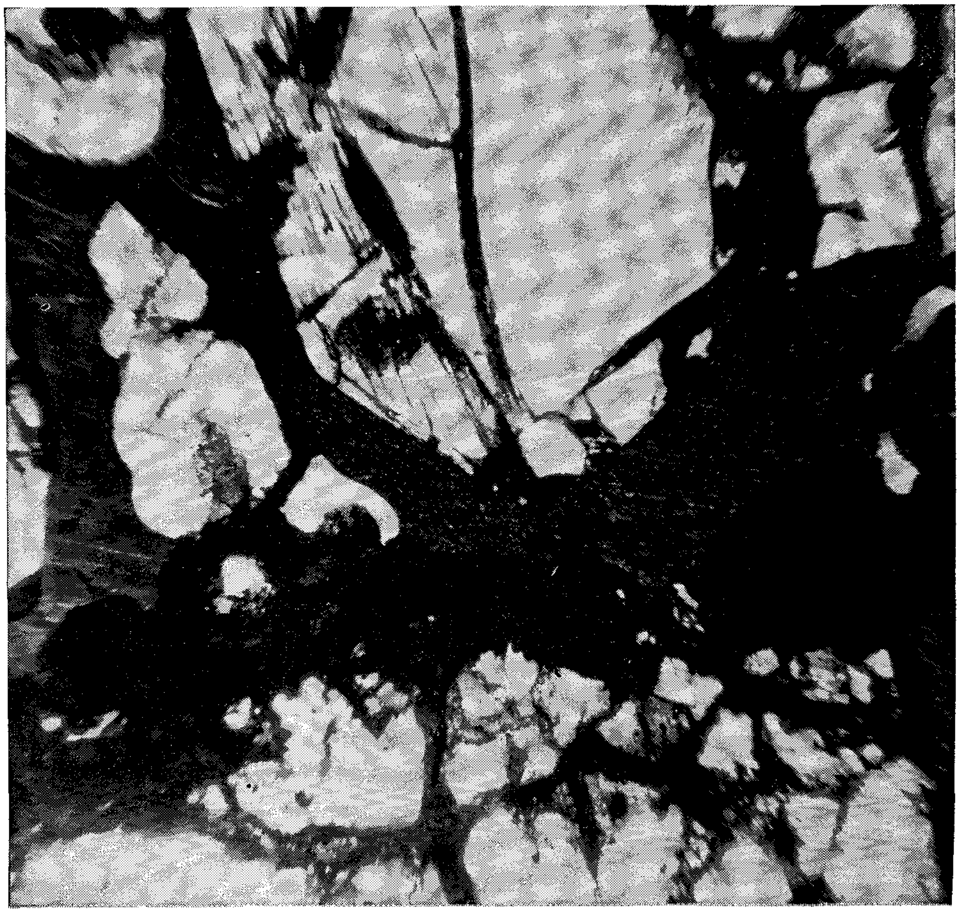

20 km/sec we may see such phenomena more commonly.

A fascinating problem in this respect is that of Goalpara which fell in India in 1868. This is a urelite consisting of pigeonite and olivine. It also has graphite and carbonado diamonds. Anders has already commented on the morphological similarity between Goalpara and the sheared Coconino sandstone at Barringer Crater. By another coincidence the fragments of the Arizona meteorite also show carbonado diamonds. Analysis of the Coconino sandstone reveals the presence of calcium and magnesium. Now we can set up the equation:

$$\underbrace{\left\{\begin{matrix}\text{Fe, Ni}\\ \text{Graphite}\\ \text{Diamonds*}\end{matrix}\right\}}_{\substack{\text{Arizona}\\ \text{Meteorite}}} \overset{\substack{\text{at 20}\\ \text{km/sec}}}{+} \underbrace{\left\{\begin{matrix}\text{Quartz}\\ \text{Calcium}\\ \text{Magnesium}\end{matrix}\right\}}_{\substack{\text{Coconino}\\ \text{Sandstone}\\ \\ \text{Fracture}\\ \text{patterns}}} = \underbrace{\left\{\begin{matrix}\text{Fe, Ni}\\ \text{Graphite}\\ \text{Diamonds*}\\ \text{Pigeonite}\\ \text{Olivine}\end{matrix}\right\}}_{\substack{\text{Goalpara}\\ \\ \text{Same}\\ \text{patterns}}}$$

Could be!

Conclusions

After examining several types of meteorites, we believe there is corroborative evidence for our earlier proposition that hydrocarbon bearing meteorites, such as Orgueil and Ivuna, could have been blown into space by the explosion of a large iron primary. This evidence is that other meteorites also look as though they have been subjected to the same treatment in that they are strongly contaminated by nickel-iron in most cases and tainted in nearly all others.

All the stony meteorites give evidence of having been violently metamorphosed in a fashion suggestive of an intense shock wave. The experimental work indicates that the achondritic or chondritic condition of the meteorites is an indication of the speed of onset of the shock wave. This corresponds roughly with the concentration of the nickel-iron which may indicate closeness to the meteoric explosion.

The nine-hundred-to-one ratio of silicate to iron in observed meteoric infalls is evidence of one large iron for many small silicates, as one would expect from a large meteoric impact.

The evidence that some meteorites came from warm active environments and others come from cold inactive environments argues strongly for separate origins of these two types of meteorites.

The evidence that the metallic phase of the meteorites was formed millions of years after the silicate phase as determined by isotopic content as well as certain morphological considerations strongly suggests that the metallic phase was injected into the stony phase, possibly by a meteoric blast.

Experimental work in meteorics seems to indicate that chondrules were formed under conditions of fiery explosive volatilization similar to those obtained at the site of a heavy meteoric impact.

To explain meteoric morphology we may have to think in more exotic terms of cold-solid to solid, and solid through solid reactions. Similarly, when we think of plasmas, we must remember their cosmic-ray type of characteristics.

Acknowledgments

I wish to acknowledge the assistance of John W. Campbell, who patiently listened, analyzed and contributed to all the arguments herein revealed as a partner in thought. I also wish to thank Doctors Brian Mason, Warren Meinschein, Robert Dietz and Alexander Knoll, who lent material and contributed much assistance.

Bibliography

1. Anders, E., "Two Meteorites of Unusual Short Cosmic Ray Age," September 1962
2. Baldwin, Ralph, "Measure of the Moon," March 1963
3. *Encyclopedia of Science and Technology,* "Plasma, Seismograph."
4. Fredrikson and Ringwood, "Synthetic Chondrules" *Geochimica et Cosmochimica Acto,* June 1963
5. Frondel, C., "Silica Minerals," 1962
6. Harper, G. W., "Observational Difficulties," Analog, May 1963
7. Mason, Brian, "Meteorites," 1962
8. Milton, D. J. and De Carli, P. S.; Maskelunite: "Formation by Explosive Shock," *Science,* May 1963
9. Nininger, H. H., "Out of the Sky" 1952
10. Watson, F. G., "Between the Planets," 1956

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* I always put an asterisk after the word **Diamonds***—particularly if they are in the **plural. I** can't think of anything more appropriate.

IN TIMES TO COME

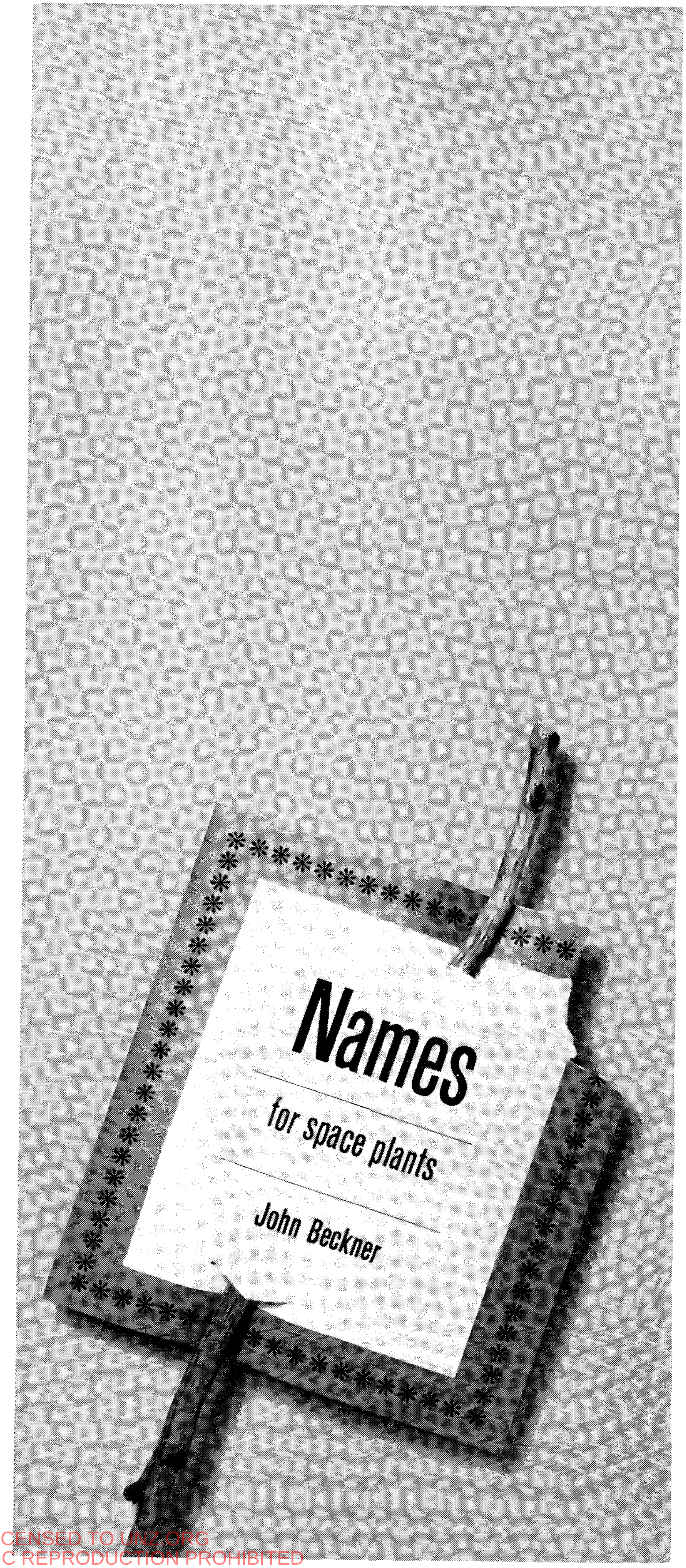
Next issue's feature will be the first half of Murray Leinster's new novel, "Spaceman." Murray Leinster—also known as Will F. Jenkins—was this year's Guest of Honor at the annual Science Fiction Convention—a spot well earned by a long, long career in the field. Vol. I No. 1 of the old original Astounding Stories of Super-Science *contained a long novelette by Murray Leinster, "Tanks"; it's appropriate that he's also with us as Vol. LXIII No. 1 starts. And "Spaceman" has the authority of the old master—and a lovely gimmick of the science-fiction type concerning the origin of the spaceman's myth, "the other side of nowhere." Which is where you land if you fall through the wrong side of hyperspace, of course. The place where no laws work, and the impossible is normal! The place where the harder you push something, the faster it comes at you . . .*

And it's quite largely the tale of a completely monomaniacal captain, with a quite understandable, very patient, and quite horrid little plan . . .

He had a little list . . . but he had no names he could put on it.

THE EDITOR

You may not know it—but the system for naming extraterrestrial plants has already been established . . . and used!



Names

for space plants

John Beckner

Science cannot advance unless its results are communicated clearly to all interested parties. Indeed, science has little excuse for existing unless this is done. To facilitate such communications, each specialty has developed rules for naming its phenomena. The names and abbreviations of the chemical elements, and the rules for using these in the formulas of compounds, are perhaps the best known of all such sets of rules.

The biological sciences have the oldest and best established system, however, in the Latin, or Linnean names, for all animals and plants. This system is subjected to a great deal of misunderstanding and distortion on the part of people who have not specialized in taxonomy—the science of classification. Be that as it may, the system works very well in trained hands, and is indispensable today.

The rules by which these names are used are set forth in separate "Codes" for animals and plants. The differences in the two Codes are not earthshaking, however. The plant Code is the "International Code of Botanical Nomenclature," published in 1961 and scarcely different from the earlier editions. This Code is constantly studied, and revised at intervals, by the International Association for Plant Taxonomy, which publishes a magazine, *Taxon,* at the somewhat unusual rate of nine numbers a year.

And all this is just background for a blockbuster development that has certainly stunned this Science Fiction fan.

Names for Space Plants

For this little-known, academic, highly specialized technical journal has recently published a one and a half page article on:

"Considerations of Extraterrestrial Taxa," by George Claus and Bartholomew Nagy.

The science-fiction fans need only know that "taxa" is a technical general term for any unit in classification, species, genus, family, or any other. Not content with this article, which I will return to in a moment, the same issue has an editorial note, unsigned, about one half page long, on:

"Extra-Terrestrial Taxa".

We can ignore the difference in writing "Extraterrestrial" vs. "Extra-terrestrial." This editorial note admits that Claus and Nagy's article may "come as somewhat of a surprise." It then offers a little background data on those extra-terrestrial taxa already under scientific—terrestrial, that is—scrutiny.

To return to the article, I should explain that people who wish to change the existing Code, send proposals to this effect to *Taxon*, where they are printed for world-wide consideration. Then, at some later date, if support is evident, these changes are taken up at one of the periodic Botanical Congresses, and if passed there, become part of the Code. The proposals made by Claus and Nagy, therefore, have no more standing, officially, at this time, than does a U.S. Congressional Bill, freshly submitted to a subcommittee. But their proposals are in the hopper and may well be approved at the next Botanical Congress.

Claus and Nagy propose that extra-terrestrial plants be named along similar lines to earthly ones, except that certain procedures be followed to avoid confusion of the two groups. In itself, this looks logical enough, but I wonder how many taxa they envisioned being dealt with at later dates. If a rich fauna or flora, plus fossiles, should turn up anywhere in space, on Mars, or beyond our Solar System, then the present system may well become overburdened. If any sort of faster-than-light drive is ever, somehow, invented, then the poor taxonmists will probably go mad. For how could you keep straight all the billions of genera and species our own little galaxy probably contains? If it has only 10^{10} planets with living things on them, and each of these has only 10^{6} living species, plus a mere 10^{5} fossil species that would be turned up by a hasty, rather casual geological survey, then we would need a system for a conservatively estimated 1.1×10^{16} species.

Of course, by then the Code can be amended through proper channels to take care of this problem, if it ever arises.

If someone with the genius of Linnaeus can think of a practical way to do so.

A distinctive set of numbers, such as:

449109467324578234

might be used, except for a few little details. In the first place, how do you remember these number groups? People need names of plants for every day use in gardens, flower shows, laboratories, pharmacies, seed-company offices, breeding and experimental stations, florists invoices, etcetera. Somehow, I cannot see a number group being accepted by these people for such uses. Then, too, a number system lacks redundancy. Vitally important botanical publications, like the *Index Kewensis*, and articles on ecology, have page after page of Latin names at present. These long lists inevitably include misprint. Usually no harm is done, because you can alter a misplaced one or two letters in most botanical names without confusing anyone about what species you meant. Take a name like Rodriguezia secunda, for instance, and look at how many ways you can misspell it without altering the general appearance of the words. Anyone who knows this pretty little South American orchid could read the garbled versions and guess at once what was intended.

Another little problem with a number system is: How do you indicate subspecies, varieties, and such? Added numbers or letters? Then again, our present system is very comforting, since so often the name gives us a clue to the plant. When a botanist sees a name such as Ceratopteris, Thelypteris, Rhipidopteris, or Nematopteris, he knows it is almost surely a fern by the "-pteris" suffix. By the same method he knows that Dryadorchis, Dactylorchis, Lecanorchis, Corymborchis, and Sylvorchis must be some sort of Orchids. (Sadly enough, misleading names do occur, now and then.) If we assign certain blocks of numbers together to show relationship, however, some of them will never be filled up and others will soon overflow. And what about hybrids? Shall we call a certain one:

(449109467324578234 x
111348375583461092) ?

The reader who chooses to brush aside this last item had better contemplate the fact that reputable botanists estimate one half or more of the higher plants here on our planet, are hybrids.

To return from this digression to Claus and Nagy's article in *Taxon*, they urge that form-and organ-genera used for terrestrial plants not be extended into space. When a palaeobotanist studies the plant fossil in, say a coal bed, he generally finds numerous broken fragments of uncertain classification. It has been the practice, approved by the Code, to give these organ- or form-genera names to keep track of them until better specimens come along. Sometimes the root, the stem, and the leaves of one tree had separate names until good enough specimens were found to prove all went together. Or again, numerous leaves of similar shape were all put together under one name until it was eventually found that some of them were not even vaguely related to certain others. So Claus and Nagy are just trying to spare confusion between terrestrial and extraterrestrial fragments by not having the same names applied to both.

Their next proposal is a technical one, urging the use of the type system in space. While some unsympathetic geneticists and plant physiologists seem to have always regarded the taxonomist's "types" as unearthly and unwanted, they are just a device for pinning every name down to a good solid physical referent. So no one can seriously quarrel with this. A couple of other proposals similarly merely require that extraterrestrial plants be treated with the same procedures as terrestrial ones when they are named.

Probably the most interesting proposal, and the one that, if accepted, will make our present historical period long remembered by xenobioligists, is Claus and Nagy's proposed starting date for extraterrestrial fossils. All names of animals and plants, living or extinct, have their acceptance by biologists based on their "priority." This amounts to saying that the first person to name a species will have his name for it used from then on, if he only did the job properly. (Certain articles of the Code spell out in detail what this involves.) So anyone who names it something else, later on, is just out of luck.

This is fair enough. We honor Edison as a great inventor for his first electric light, but we tend to ignore Willie Glootz, who is working on GE's assembly line, making sixty-watt bulbs. Honor to those who blaze the trail, even if it is only by giving a name to a new kind of crabgrass. But there has to be a limit to this, or people would be constantly delving into older and older Latin, Greek, Hittite, and even Chinese manuscripts and then upsetting the familiar names of our common crop plants. If this could happen, the decipherment of the Cretan Linear A or the Indus Valley script would be a boon to the archaeologists and a chaotic nightmare to the biologists and agronomists.

But this will never happen, since the problem was solved long ago. The great Swedish scientist, Linnaeus, was the inventor of our binomial system of Latin names for animals and plants. Since this system first appears in his "Species Plantarum," published on May 1, 1753, that is the absolute earliest date accepted for a plant name. Fossil plants—terrestrial, that is—are accepted only from December 31, 1820, when Sternberg published his "Flora der Vorwelt."

The blockbuster that has rocked me —and a few other people—is in the starting date chosen by Claus and Nagy.

It is October 1, 1961.

Back in the good old days we used to speculate on extraterrestrial life. But we did not expect to find the first solid report on the subject had been put out a year previous to our knowledge of it. Without fanfare, without trumpets. Claus and Nagy do mention that O. Hahn, in 1880, had published a paper on organisms in meteorites, but they imply quite clearly, that they do not regard his work as very well substantiated.

The organisms Claus and Nagy are concerned with at this time are plant fossils found in meteorites. Dr. Ralph A. Hall, in Analog for June 1962, has presented a clear and ingenious mechanism by which many of these might have originated on Earth. At first glance this wipes out the value of Claus and Nagy's discoveries, but a second view will restore them to importance. We need a carefully prepared system of naming any extraterrestrial life, wherever or whenever we do find it. Even if their metorite systems did start out on Earth, that is only a guess, though based on careful consideration of the possibilities. At this point we cannot know for sure, nor prove that they started out here.

Dr. Hall suggests that certain tektites were splashed off the Moon and hit Australia. A few heretics suggest primitive life forms just might exist on the Moon. Other "radicals" have suggested possibilities of life on Venus, Mercury, Jupiter, Titan, the Asteroids, etcetera. If, as Dr. Hall suggests, we have sent interstellar passengers off the Earth, then we could also be receiving them from other Solar Systems.

And Frank Salisbury, of Colorado State University, writing recently in *Science,* has offered what, to my mind at least, is extremely convincing evidence of life where we have most expected it all along, on Mars. A large meteorite could have hit any of these places in such a way as to splash fossil bearing rocks into space where they ultimately could reach the Earth. We can't know for certain, at this time. But we do know, beyond a reasonable doubt, that meteorites are reaching the Earth from outer space. So it seems logical to regard any "passengers" as extraterrestrial until proved otherwise.

October 1, 1961. The date on which Homo sapiens first revealed that it had made contact with life from off its home planet. Even if that life was very primitive and very dead at the time. I can't even remember what I was doing on that momentous day.

REFERENCES:

1) *Taxon,* "Considerations of Extra-terrestrial Taxa," George Claus and Bartholomew Nagy, June 1962, pp. 160-161
2) *Taxon,* "Extra-Terrestrial Taxa," June 1962, p. 178
3) *International Code of Botanical Nomenclature,* Lanjouw et al, Utrecht (1961)
4) *Analog Science Fact-Science Fiction,* "Interstellar Passenger Capsule," Ralph A. Hall, M.D., June 1962, pp. 83-102
5) *Science,* "Martian Biology," Frank B. Salisbury, April 6, 1962, pp. 17-26
6) *Science,* "Lifelike Forms in Meteorites," Harold C. Urey, August 24, 1962, pp. 623-628

BRASS TACKS *(continued from page 5)*

of them concerns the series of stories by Winston P. Sanders—good stories, by the way—which have been appearing in Analog. The primary postulate of this series is a chemical industry on the asteroids, whose raw material consists of chunks of Jupiter's atmosphere picked up by "scoop ships," which, by ram action, pick up the stuff, compress it, and get it out for transferral. Now, these ships are going to have to move rather fast to compress this collection of gas appreciably. In fact, they resemble a rocket being pushed backwards and forced to imbibe its own exhaust stream. And the rocket equations are applicable, and I made a few calculations. Approximate, of course, but they'll be good enough.

Let us assume that your ship is coming into the atmosphere at some 10,000 meters per second. (The escape velocity for Jupiter is 60,000, so that's more than conservative.) Assuming that the gas is all H_2—the most optimistic assumption possible—there will be 24.09 kilocalories per mol of heat to get rid of. Assuming constant pressure condition—again, highly optimistic—and assuming that the gas is at absolute zero to begin with—it ain't so—the stagnation temperature of the engulfed gas will be some 3100°K.—5120°F. However, the conditions are not constant pressure, but a rapidly increasing pressure, so that the heat capacity of the gas would be reduced, and the actual temperature might approach 4000°K, the C_v limit. If the gas were methane, there would be 191.2 kilocalories per mol to absorb, and the temperature runs off the end of the thermodynamic tables compiled by the learned Dr. Stull. (They stop at 6000°K.) And if you were coming in at the escape velocity, the temperature, assuming no dissociation, would be some thirty to thirty-six times higher. Of course, everything would dissociate like mad, not to mention ionize, and your ship would have a bellyfull of plasma. This, of course, is all very ducky, but what are you going to keep it in?

Item number two. Some days ago I was doodling over the fundamental constants. (We're all cosmologists at heart, and want to beat Eddington at his own game.) And I came up with the damnedest relationship—or coincidence—ever. Consider. Here are the symbols:

ε = the electronic charge 4.80286×10^{-10}esu.
m = the electronic rest mass 9.1083×10^{-28}gms.
h = Planck's constant
c = velocity of light in a vacuum.
D = Dielectric constant of a vacuum, defined as 1.0, exactly.
G = gravitational constant 6.670×10^{-8} cyne cm^2 gm^{-2}.
a = fine structure constant, $= hcD/2\pi\varepsilon^2$. $1/a = 137.0373$.
e and π have their usual mathematical significance.

Now, if we designate the electrostatic force between two electrons by F_e, and the gravitational force by F_g the ratio between the two, $F_e/F_g = \varepsilon^2/m^2\, GD$, which, numerically, equals 4.17×10^{42}. But it is also possible to write the very simple function $2^{1}/^{a}e^{\pi}$, and, when you plug in the numbers, find that equals 4.14×10^{42}.

This may be numerology, and it may be coincidence—but a coincidence that slides over forty-two orders of magnitude and then agrees within three fourth of a per cent is a rather spectacular coincidence. Suggestions, anybody, or any ideas on what goes on here?

Cosmologists of the Cosmos arise!

John D. Clark

Mm-m-m—well, the scoop ships are designed to let 90% of the gas escape, carrying off 99% of the heat, may be—?

Dear John:

Dr. Clark makes three good points in his letter, but I don't think the first, at least, is unanswerable. True, the scoopships can't go too fast in the Jovian atmosphere. But then, I never said they did. I'd hate to dive into that stuff even at 10,000 meters per second—especially since the pressure gradient must be much greater than it is for Earth. The idea is that you decelerate to ordinary air speeds before entering the atmosphere. The compression factor needn't be too great, since the gas is already at high pressure. Furthermore, it was stated that most of the hydrogen was thrown out. Expanding, it should take most of the heat with it.

I admit, though, that perhaps this should have been made more clear in the story.

His "numerology" is most interesting, but I'm not enough of a physicist to comment. As to his third point . . . well, shucks, he did say "damned good stories," and who am I to contradict so distinguished an authority?

William P. Sanders

Dear Mr. Campbell:

Ref: "Seagoing 'Space' Ships," by Charles Layng, November 1963.

On page 11 Mr. Layng states "These are the only ships in the world with two engine rooms—one for nonpropulsive power and one for driving the ship."

Has Mr. Layng never heard of Navy minesweepers of the MSC (0) type? These ships, built back around 1943, fit the bill.

Robert S. Fritzius
111 Andrew Place,
Apartment D,
W. Lafayette, Indiana.

Don't know whether Mr. Layng had or not — but I hadn't! Correction accepted!

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P. SCHUYLER MILLER

GROUND RULES

At the Labor Day "Discon," the Twenty-First World Science Fiction Convention in Washington, D.C., the "Hugo" Award for best science-fiction novel of 1962 went to Philip K. Dick's "The Man in the High Castle." This was certainly one of the most well-deserved awards in years: the book is remarkable. For the second time, a book published only in a hardcover edition has taken the award.

The Hugo for best short fiction went to Jack Vance's "The Dragon Masters" from *Galaxy*, also out in an Ace paperback—which may have helped against contenders that were not so available. There was no award for a dramatic presentation, and the rules were amended so that a *single* TV production—not a series—must contend against individual motion pictures in the future. Roy Krenkel was named best artist for his cover art on the Ace paperback editions of Edgar Rice Burroughs reprints. *Fantasy & Science Fiction* took the "best magazine" award, and *Xero* was rated the best fanzine.

As you know, Isaac Asimov also received a special Hugo, awarded—like a Nobel Prize—for all-around good work. And this department was honored by another special Hugo. I'm not sure why. I have never pretended to rate books against a set of high, objective standards of literary performance such as Damon Knight holds. Neither has John Campbell ever set any "house rules" other than to rule out any but exceptional fantasy, and to decide which of the individual reviews I turn in he will use. Still, I do have some ground rules, and I'd like to comment on them here.

First and foremost, an author should be rated on the basis of what he tried to do when he wrote his story—not for what I or some preconceived set of measures hold he should have done. H. Beam Piper's "Space Viking," you read here as a serial or more recently as a paperback, is not at all the same kind of story as, let's say, the Pohl-Kornbluth "Space Merchants," nor was it intended to be. Even so, it is a prime example of the plus values in science fiction.

It seems to me that magazine and paperback science-fiction is primarily a medium of entertainment which has to appeal to general readers as well as to addicts or fans. Fandom simply is not large enough, or single-minded enough, to support any one magazine. Editors have to buy, and writers have to write stories that people will read. Not long ago reading was a more popular form of entertainment than it seems to be now—as witness the demise of the general fiction magazines and the dwindling amount of fiction in the big magazines that sell in the millions of copies. In this respect, the science-fiction magazines and detective story magazines are fossils. It remains to be seen whether they are freaks like the coelocanth, or have achieved the immortality of ants.

Science fiction cannot, in consequence, be *primarily* a medium for social messages, experimental writing, or self-expression with no particular attempt at communication. The "little" literary magazines can and do indulge in this kind of luxury, but they make no pretense of paying their own way, as every science-fiction magazine has to do. By the same token, science fiction dare not become cultist to the point where new readers can't understand what is going on. There is room for a good deal of variation, of course: Analog represents the "classic" science fiction that has appealed most to scientists and engineers, whereas *Fantasy & Science Fiction* has concentrated on literary quality.

Nevertheless, within these limitations, science fiction offers and editors like John Campbell have encouraged the greatest possible variety and freedom to do all the things "serious" fiction attempts with fewer handicaps. Let's look at "Space Viking" again. On the surface it is a very good interstellar adventure story, and worth reading as such. But Beam Piper, an old pro at this stuff, has not stopped there. I don't know whether he is drawing a parallel with history or simply reasoning from the nature of human beings, but he has brought to light and life some very important principles of human society. The Sword Worlds drained themselves of talent and vigor when they exported their best people to Tanith. And Tanith had to change from a plundering to a trading society or go down in its turn.

There haven't been many "great" characters in science fiction, and I'm not about to say that Lucas Trask is an exception. But you'll recall that Trask does change as the story progresses; he grows, and his understanding of human society grows with him. That is more than "mere entertainment."

These are qualities you *expect* to find in adventure science fiction by writers like Poul Anderson and Gordon Dickson and Robert Heinlein. There are, as you know, many others—a play of ideas that, in many cases, literarily oriented critics can't understand.

In a British Broadcasting Company interview, reprinted in *Cavalier*, the poet and author of "Lolita," Vladimir Nabokov, said: "I don't think that an artist should bother about his audience. His best audience is the person he sees in his shaving mirror every morning. I think that the audience that an artist imagines . . . is a room filled with people wearing his own mask."

This is not an extreme point of view; we have all encountered it. But if this is art, if this is literature, science fiction cannot *afford* to be literature . . . for its very essence is communication of a variety of ideas to a variety of people. And it has to lure them into coming to listen.

Stories that do this may not be great literature, but they are good science fiction.

NEVER TOO SOON

The Twenty-Second World Science Fiction Convention will be held in Oakland, California on September 4 through 7, 1964. Guests of honor and dinner speakers are Edmond Hamilton and Leigh Brackett—Mrs. Hamilton—as long overdue for the honor as was Murray Leinster, the guest of honor in Washington.

This year the program will begin a day earlier than usual, Friday, September 4th. All the usual features are planned.

Convention membership is, as usual, $2.00 in advance with an extra $1.00 registration if you attend. This gets you advance bulletins and other literature—in Chicago, for instance, you got the *Proceedings*. Send your check to William Donaho, Treasurer, Pacificon II, P.O. Box 261, Fairmont Station, El Cerrito, California.

Convention hotel is the Hotel Leamington, Franklin & 19th Streets, Oakland, California. Those reservations you'll have to make yourself, but there will be forms in future Pacificon progress reports.

Incidentally, if you are going to be in England come Easter weekend, the British National SF Convention will be held at the Hotel Bull, Peterborough. For information, write Anthony Walsh, 167 Sydenham Road, Bridgewater, Somerset, England.

IT WAS THE DAY OF THE ROBOT

By Frank Belknap Long • Belmont Books, New York • No. 90-277 • 1963 • 141 pp. • 40¢

The cover of this book—an army trying to pull down a gigantic robot—is not a scene from the story. Presumably it is intended to be symbolic of the struggle of regimented men against a computer controlled society.

It is also a genetically regimented society in which men and women are bred to meet the state's projected needs for certain types. John Tabor, back on leave from a Venus Colony where there are no women, has been denied the right to marry: his type won't be needed for a while. So he buys an android woman made to match his ideal—and is almost at once a fugitive.

Frank Long, it seems to me, has always been a writer who feels his stories rather than constructing them mechanically. Here he has done his best to show us the decadent society of the Twenty-third Century in grim glimpses, as the fleeing couple twist and turn in search of a refuge. The pictures are too grim and the action too fast for the reader to take time to analyze this society and decide whether it hangs together. Certainly the overwhelming impression is of utter *in*efficiency—the reverse of what might be expected if the "robot" really ruled. Perhaps the author is suggesting, rather than telling us, that 2263 is really not the "day of the robot" but of a bureaucratic oligarchy that pretends to act in the name of the Big Brain.

THE FUTURE TOOK US

By David Severn • Penguin Books, Baltimore, Md. • Puffin 177 • 1962 • 159 pp. • 85¢

This is an English juvenile, well written and well illustrated, but by no means on a par with those of John Buchan's adventure novels that are in the same series. It is typically a "boys' adventure book" in the sense the English use it: that is, the two boys who are snatched into the future *act* younger than their counterparts in American juveniles, yet the writing and concepts are more mature—books like those by Heinlein and Norton always excepted.

The boys have been brought forward to an England of about 3,000 A.D. as a result of a fumbled effort to capture the Head of their school, a mathematician whose textbook is the only volume from our time to have survived. The world they find is a highly unpleasant one, in which a cadre of pseudo-mathematicians maintain just enough technology to keep themselves comfortable, while the populace is kept on a hand-to-mouth level comparable to the serfdom of the Dark Ages. Naturally, the boys are soon knee-deep in a resistance movement.

Well done, if for younger boys than most of the juveniles we have noted here.

SUPERMIND

By Mark Phillips • Pyramid Books, New York • No. F-909 • 1963 • 192 pp. • 40¢

This is the third of the adventures in psidom of Her Majesty's FBI Agent Kenneth Malone, expanded and revised from the serial published here as "Occasion for Disaster" in 1960-'61. Whether the pseudonym "Mark Phillips" still conceals the combination of Randall Garrett and Laurence Janifer, publisher sayeth not this time.

This time the FBI is called in because everything is going wrong — business, government, even *Cosa Nostre* and the Soviet spy network are getting hopelessly tangled in human errors. Is there a psionic source for this muddle? Why, sure there is—and Malone and his usual cronies are just the men to find out what is going on.

Fun is fun, as usual, but in the end Malone emerges as a superman himself, and that is cheating. The effect is rather like Dr. E. E. Smith's spoiling the book versions of his "Lensman" series by spelling out the forces operating behind the scenes. Maybe—like Conan Doyle before him—Mark Phillips has grown bored with his hero.

GLORY ROAD

By Robert A. Heinlein • G.P. Putnam's Sons, New York • 1963 • 288 pp. • $3.95

This is Heinlein's contribution to the sword-and-sorcery genre, serialized last year in*Fantasy & Science Fiction* and dedicated to George Scithers, publisher of *Amra*, the scholarly journal of the field. True, its magic is revealed as the science of a continuum operating under different laws than ours, and its hero is both reluctant and fumble-fingered, but the mood and manner are in the best tradition.

"Scar" Gordon has had altogether more bad luck than any man really deserves, and has bounced back out of an inherent toughness that he would be the last to acknowledge. After one last ill-fated attempt to get something for nothing, he investigates a peculiar advertisement and promptly finds himself a hired hero in the service of the most beautiful woman in twenty parallel universes; as it turns out, she is their near-immortal Empress, but that is another part of the story. With her and a rascally old retainer, Rufo, he sets out on an obscure and thoroughly perilous Quest whose actual nature is never made clear to him until it is all over.

He copes with an ogre and the thoroughly nasty Horned Ghosts. His gentlemanly instincts nearly lose them all their lives in the pleasantest world they visit. He handles dragons pretty nearly by the gross and has a terrific sword duel with a Soul-Eater who protects a magic Egg in the strangest land of all. He achieves his Quest, he wins his Lady—and he finds that the wine of victory is corked and sour. There is no more end to the Glory Road than there is to a Moebius Strip. Time and again you'll swear that none of their blundering into trouble would have happened if Star or Rufo had sat down for ten minutes by a campfire and spelled out the facts of life to our stupid Hero. That's explained later, whether you accept the explanation or not. My advice is to ride with the story, but keep one ear open for the music of the countryside and the author's running commentary on the psychology of heroes.

SPECTRUM II

Edited by Kingsley Amis and Robert Conquest • Harcourt, Brace & World, Inc., N.Y. • 1963 • 271 pp. • $4.50

The thing for American readers to remember about these anthologies—*Spectrum III* is already out in England—is that they are compiled for English readers who are supposed to know nothing about science fiction, but who may have encountered some of the English variety. The result is that they consist almost entirely of American stories, and almost entirely of familiar ones. Of the eight stories in this collection, only one is English, and all of them were published in the interval between 1946 and 1958—half of them here in Astounding, as it was then.

This handicap out of the way, the collection is a better one than the editors' first *Spectrum*. They are not the best stories from that twelve-year period, though they may be the ones the editors liked best, which is one basis for assembling an anthology. They are good stories that illustrate the variety of science fiction, from the schizoid future of Wyman Guin's "Beyond Bedlam" to the intellectual jape of Isaac Asimov's "The Feeling of Power," in which a technician in a computerized world rediscovers arithmetic. You have a disturbing vision of time travel in Henry Kuttner's unforgettable "Vintage Season," the oldest and best of the lot, and a fairly representaive psi story in

Mark Clifton's "Sense from Thought Divide," the second of the psionic adventures of Personnel Manager Kennedy. These both appeared here originally, as did the poorest of the lot, A. E. van Vogt's "Resurrection," which carries his favorite Superman theme to the point of self-parody.

The fourth of Astounding's contributions is another of the best: James Blish's "Bridge," which clobbers the reader with the sheer force of what is going on, then slips the meaning to him gently. The story is a prelude to the *spindizzy* series that has taken the cities of Earth out among the stars. Another forceful one is Philip K. Dick's "Second Variety," in which the Last War is ended, not in an atomic holocaust but with robots designed to destroy men becoming cleverer and cleverer at their programmed task. And the Brian Aldiss story, "There is a Tide" from the English magazine, *New Worlds,* is a technological story about humanity's persistent battle against Nature and digged refusal to coexist or work with her. There's a twist in the last sentence that really isn't needed.

So you've read 'em all? Suggest it to a friend who doesn't read science fiction. He'll get a better idea of what its possibilities are than *Spectrum* gave him.

THE GRAY ALIENS

By J. Hunter Holly • Avalon Books, N.Y. • 1963 • 192 pp. • $2.95

This is the author's best job of writing since her memorable "Encounter," but you are entitled to discard it totally, because it delves deep into the kind of mysticism that swaddled Doyle's great Professor Challenger in "The Land of Mist." The ghost of the hero's dead wife lends a hand in the final solution and a kind of theosophical continuum is set up to incorporate living creatures, ghosts, and the shadow-things which give the book its title.

The characters are real and so is the menace: bodiless shadows that nevertheless can dissolve human beings in seconds and wield massive cosmic forces. It would have been a much better, or more conventional story if the embattled people of a country town had found some more tangible way of fighting back, and if the Shadows had actually been from space. Then, I suppose, I'd have complained about stereotypes and clichés . . .

FIRST FLIGHT

By Damon Knight • Lancer Books, New York • No. 72-672 • 1963 • 160 pp. • 50¢

The short stories and novelettes in this collection are the first-published science fiction of ten of the field's top writers. Eight of them were originally published here, in the days when Analog was Astounding. Two—A. E. van Vogt's "Black Destroyer" and Judith Merril's "That Only a Mother"—are among the best stories their authors have written, and classics in their own right.

It is interesting to note that there are not as many "gimmick" stories as you would expect. L. Sprague de Camp's "The Isolinguals" is one, and a fair example of the author's comic twist to novel ideas. Robert A. Heinlein's "Life-Line" is one, but it is concerned with the effect of the gimmick. Theodore Sturgeon's "Ether Breather" is an antic that certainly does nothing to indicate its author's future development or concerns. Brian W. Aldiss' "T" is also one, and shouldn't be, for it appeared in 1956 when the gimmick era was pretty well gone.

But Lester del Rey in "The Faithful" was commenting on the human traits we would like to see perpetuated in the race that follows man. Poul Anderson in "Tomorrow's Children" got at a truth that few people have yet accepted. Judith Merril's story is, of course, deeply human and Algis Budrys' "Walk to the World" is concerned with human reactions to a world of space flight. Even Van Vogt's "Black Destroyer" gets under the skin of its super-creature.

Finally, Arthur C. Clarke's "Loophole" is in a sense a gimmick story, but the gimmick appears only in the final twist, like a rabbit out of a magician's hat. It and Aldiss' "T" are the poorest of the ten stories, and do little to suggest their authors' real place in modern science fiction. The others, except for the Sturgeon story, do seem characteristic of the lines these ten writers would follow.

DOOMSDAY, 1999

By Paul MacTyre • Ace Books, N.Y. • No. F-201 • 1963 • 158 pp. • 40¢

The author of this quietly good story is a Scottish historian; it was published in England as "Midge," a title which describes its subject better but hasn't much appeal west of the Atlantic.

In a manner resembling one of John Wyndham's underplayed cataclysms, the author describes a Scotland where the crumbled remnants of civilization are barely hanging on. China has waited in the wings while Russia and America flew at each others' throats and ruined the world between them, then poured out over the ruins. A European police state has outposts north of an unnamed river; south are the fringes of the Chinese. Between are the midges—insects that can be harmless or deadly, seemingly without cause. They are mutants with the power to kill, but Angus, a hunter for the police camps, is not harmed by them.

A Chinese helicopter, crashing near the hunters' lodge, sets a wild chase in motion: to the Chinese camp, then back, with Angus and the Chinese woman officer, Major Liu, seemingly aided by the midges. The secret of their immunity is, of course, something everyone wants.

It's a good yarn, well told.

HOW TO BREED A SUPERIOR RACE

Continued from page 7

The dodo died; it was a flightless bird that evolved on an isolated island where it had no competition from predatory land mammals. Its extinction has been ascribed to sailors who killed them for meat, fat, and feathers; ornithologists generally believe that it wasn't the sailors half so much as the sailor's age-old and inescapable companions—the rats. The dodo was good enough to survive, provided it wasn't exposed to the problem of active, aggressive omnivorous mammals. A swan is about as massive as a dodo was; watch a swan's reaction to a rat some time! Or watch a flock of barnyard chickens go to town on even so aggressive and capable a fighter as a rat!

South America, at one period of geological history, was cut off from North America and the rest of the Earth's land masses. During that time, a complete marsupial evolution developed in South America. There were saber-toothed—marsupial—tigers, and various other carnivorous and herbivorous life forms making up a complete ecology of marsupial forms.

Then came a geological catastrophe; the marsupials were doing fine, were all-weather, all-climate competent. But not all-catastrophe proof. A land bridge to North America formed, and the placental mammals from North America were able to get in.

It turned out that placental mammals were superior to marsupials. In whose terms? The only terms Nature and the Universe ever have or ever will recognize—whether we think they're Good, Just, Fair, or Evil, Wicked, Opportunist, et cetera. South America is full of placental mammals today, and there are only a very few remaining marsupials.

Now it must be recognized that, when that land-bridge formed, the placental mammals were subjected to exactly the same order of catastrophe that the South American marsupials encountered; they, too, were suddenly exposed to the competition of an alien ecology. The rats who landed on the island of the dodoes were, also, being exposed to an alien ecology.

When the mongoose was introduced in the Caribbean islands, with the ill-formed idea that they would kill off the snakes there, as they did in India, men soon discovered that the mongoose, like any other competent organism, makes its living on a line of maximum return for effort expended. The Caribbean bird and small mammal population declined drastically as the mongoose population soared—and the snakes weren't particularly bothered. In India, the surviving bird and animal species have made themselves mongoose-proof, so that such seemingly unattractive prey as king cobras become the most profitable game.

In trying to determine what "superior race" means, we can only take Nature's—the Universe's—definition. And judging from what's won the survival stakes—and steaks!—over the last three to four gigayears, the goal-direction of Evolution—the final product to be achieved sometime in the remote future—will be the Ultimate Omnivore. The Ultimate Omnivore will be an entity so constituted that *anything that happens to it is beneficial.*

When starlings were first introduced into this country from Europe, they drastically upset the life-pattern of many native birds, partly by competing for nesting places. Starlings nest in hollows in trees, or similar places, as do a number of native birds. The starlings are numerous, aggressive, and tough; they simply drove out many native types. The flicker, a native woodpecker, seemed unlikely to be menaced; being a woodpecker he can and does carve his own hollow in a tree—and being a woodpecker he has an exceedingly dangerous beak. Nevertheless, the flicker was driven out of the hollow he had made. He could drive off any starling that challenged him, of course . . . but while he was busy driving off starling #1, starling #2 was moving in. And when #2 was being driven off, #3 was building its nest . . .

However, this change in the ecological scene was not at all injurious to another native hollow-tree nesting bird. The attempted invasion of starlings indeed proved beneficial and nourishing to the screech owl. It made feeding his nestlings easier.

The Ultimate Omnivore is simply the entity that can adapt to imposed change faster than the imposed change harms him—and adapt in such a way that the imposed change becomes "nourishing." It doesn't mean the entity doesn't ever get hurt—but that it adapts to the hurtful pressure so rapidly the hurt does not become dangerous injury, and so successfully the pressure becomes a useful-to-the-organism effect.

In these very broad and general terms, we can talk about what "a superior race" would mean in terms of Man. It would be a race closer to the Ultimate Omnivore—and not merely closer at the physical level, but at the mental level, too. A man who, slugged by a totally new and dangerous situation, can manage to get out of it hurt, scared, exhausted—*but having learned something*—is superior. The next time that situation pounces on him, the situation, not the man, is going to get hurt!

Adaptability is the one *general* characteristic of all-round superiority in the Universe's terms. I believe that, wherever Man and his descendants may go in the future, on whatever planet we find intelligent life—we'll find they are, like ourselves, omnivores, descended from a long line of rather unspecialized omnivores. Like us, they will retain many of the most primitive features of their land-life, in quite primitive form.

Birds have specialized their forelimbs into wings; horses have specialized their feet to a single toe; elephants specialized their teeth rather fantastically. Only the primate line of evolution never did make up its mind exactly what it was going to be—only the primates never got around to being anything in particular. We still have all five digits on all four limbs, and the only trace of specialization of our teeth is, maybe, that our incisors are adapted to scraping the pulp out of a fruit's skin.

The aliens will be omnivores. When a man is attacked by an animal, he usually winds up eating the attacker; the happening has been made beneficial to him. It's been a long, long time since wolves were a major menace to Man—but the old encounters were turned into beneficial happenings. It was from them that Man learned to tame and train the dog.

They'll be aggressive. In the Universe's terms, "The good die young," is nonsense; the unaggressive die young—and if the species survives, it has to have an extremely high breeding rate. The aggressive *seek* happenings. They go out looking for things to happen—because happenings, to the high-level omnivore, are nourishing.

And they'll have, in their history, something very similar to a series of events that we have in ours, if they have achieved a technological civilization.

Let's consider what it takes to change a Tribesman and a Barbarian type of population into a Technological population. Basically, the Tribesman type lives by ritual and taboo; everything is either Forbidden or Commanded. The Barbarian believes in the absolute freedom of his will—that he alone is the Master of his Fate. The "Death before dishonor!" complex built into him psychologically equates "dishonor" with yielding his convictions to anything or anyone—facts, the Laws of Nature, and the number of opponents to the contrary notwithstanding.

Neither of those two types can ever develop a technology—until they are changed in fundamental nature. The Tribesman can't experiment—what isn't Commanded by Ritual is Forbidden by Taboo, and that includes everything in the Universe, so there is no room for experiment. It won't do the Barbarian any good to experiment; if the experiments don't agree with his convictions, neither Man, God nor Devil can make him yield his will, and certainly a few facts aren't going to.

Now an individual may be a nearly pure Type—and a population enclave can be statistically ninety per cent or more of one type. But there are always variants, plus mutants, in any population—which is what the animal breeder works on in breeding a new type. If he can't get the type-variation he wants within a population-enclave, he can, by hybridizing, introduce variations that will allow him to reassort for the characteristics he wants.

Plant breeders frequently do that; a high-yielding type of commercial tomato plant, say, lacks blight resistance, while an available wild scrub tomato is totally immune. Hydridize, then reassort the genes from the hybrids, until you get the high-yield and the blight resistance, minus the scrubby characteristics. It takes time and patience, and persistent selection to stabilize the new breed, of course.

So suppose we want to breed a more adaptable race from the Tribesman and Barbarians. And we have the absolute ruthlessness that History, Nature, and the Universe display.

The thing to do, evidently, is to set up a situation in which ninety per cent or so of all non-adaptable individuals will be killed off in each generation, and make the required level of adaptation more and more abstract as generations go on. Then we'll increase the rate of adaptation required, so that instead of one major adaptation required each lifetime, they have to make two, three, or more major reorientations per lifetime.

The continuous culling—i.e. killing off—of those who can't adapt can be offset by an increased birth rate. Since hybridization is desirable—it shuffles available genes around and allows optimum combinations of available genes—that must be emphasized. Human tribes generally have a strong resistance to interbreeding; each tribe considers its neighbors, and all strangers, different-and-inferior, and will have nothing whatever to do with them.

Barbarians differ somewhat in that respect; rape and loot are sort of co-synonymous for them, and the rape following conquest of a town is, of course, a highly effective method of hybridizing genes. This can be useful in our program of race-improvement; it simultaneously increases the birth rate and mixes the genes of many tribes.

Also, Barbarian conquest serves our program in several other very useful ways.

The Barbarian conqueror is unlike the Tribesman; the Tribesman holds that anyone who does not live by the Rituals and Taboos of his tribe is something less-than-human, while the Barbarian holds that anyone who doesn't accept and agree with his concepts is either a fool—and fit only for slavery—or an enemy, to be killed.

This latter attitude, incidentally, led to such interestingly historical proceedings as battles fought with the motto "Jesus And No Quarter!" On the other side, the Moslems were equally emphatic that there were only three possible states for a man; Moslem, dead, or slave.

Now the typical Barbarian simply cannot be a slave; moreover, he can't yield his will to another, so he couldn't become Moslem. Therefore, he joined the "dead" class. This is an effective way of culling from the breeding stock those who do not have the desired adaptability.

The Tribesman can't consider anything but the Rituals and Taboos he was indoctrinated in as a child; he can, however, accept slavery—because essentially submission to ritual and taboo is a resignation of individual will and responsibility.

Typical illustrations of this are the fact that the North American Indians, who were in the Barbarian stage of cultural evolution when the Europeans landed, *could not be enslaved.* The North American colonists, instead, imported tribesmen from Africa, and bondsmen — slaves-for-a-term-of-years —from Europe. The Barbarian Indians were racially, psychologically incapable of accepting slavery; they died when enslaved—with or without taking their would-be enslavers into death with them.

So our program of breeding a superior—i.e., more generally adaptable —race can make excellent use of the characteristics of Barbarian conquerors. The Barbarian is aggressive, intransigent, intelligent, tough, and immovably convinced of the rightness of his convictions. Justice, Honor, Good, and God are what *he* has decided they are—and not even his own God can help anyone who won't agree. Thus Jesus may have taught that "The meek shall inherit the Earth," but His Barbarian converts were certain that the aggressive would get it a lot sooner. So—"Jesus and No Quarter!"

It's fairly clear that a marching Barbarian army coming through an area will greatly reduce the population of people with inflexible mental attitudes —and mix the genes of both races. Where physical adaptability had already been developed to a very high degree in the race of Man, this new pressure—the pressure of intellectual variations—demanded a totally new *kind* of adaptability—*the ability to learn new orientations at any time in life*. Any mammal can learn in its early, cubhood stages—but "You can't teach an old dog new tricks." What the barbarian armies were demanding was that old people, well past their childhood, learn a new way of looking at Truth and Honor and Justice. They imposed on them the necessity for being "old dogs" who *could* learn new tricks.

This, clearly, will produce a population of markedly more adaptable people, if (1) it is maintained with ruthless efficiency over many generations, and (2) a high rate of culling the unsatisfactory is maintained.

Most of us are sort of vaguely and generally aware of European history; it can be summarized quite adequately as "Six thousand years of marching, countermarching, and crossmarching Barbarian armies." Some periods the Barbarian marchers milled around in circles in one relatively small area for a few generations, grinding the population first one way, then the other, as two, three, or more Barbarian armies chased each other around. Europe's history is full of the battles of successive waves of Barbarian armies, each imposing its own concept of How Things Should Be.

At first, the variations of concept were pretty broad and simple; as centuries passed, and the population developing under that program of breeding became more sophisticated, the adaptations demanded of them became more subtle and complex. At first it was Huns and Vandals and Goths vs. Romans. Later on it was Moslems vs. Christians. Then it became Catholic vs. Protestant. Of course, as the subtlety of intellectual adaptation became greater, the sharpness of culling of the unadaptable became greater, too. Things like the Thirty Years War and the Hundred Years War; it was no longer adequate to kill off the open opposition in the first four years or so —to make the program effective, it was necessary to watch the individuals for decades.

Keep up a program like that for a few millennia, and the surviving individuals will (1) be very broadly hybridized, (2) of greatly increased mental adaptability and (3) enormously more adept at concealing their mental attitudes. Also, incidentally, they will have selectively bred some remarkably deadly fighters.

As an example of the change in military ability, notice that the Romans were so abysmally stupid, so rigid in their attitudes, that Hannibal was able to defeat the Romans for just about one whole generation *by using the same tactic!* Hannibal learned how the Roman legions fought their battles; he forced engagements under conditions such that that method could not be used. For *twenty years* Rome went on losing Legion after Legion because they could not recognize and accept the need for adaptation. They never did defeat Hannibal; it was the switch of Numidian cavalry from Carthage to Rome that made victory possible.

After a thousand-year mauling by assorted Barbarian armies, a far higher level of generalship could be found in the average European sergeant.

Another two thousand years of "Learn, fool, or die!" produced a general upgrading in the educability of the race. The ones who couldn't adapt, and could not conceal the fact that they didn't agree, who could not learn to work with the will of someone else, had been culled.

Over all the Earth, where technological civilizations have arisen, you'll find that same pattern of marching barbarian armies. Marching and countermarching and grinding, generation after generation, until the people who could not learn to adapt had been culled and culled and culled, generation after generation.

Only the flexible-minded can develop a technological civilization; they are the only ones who will experiment —and will learn from their experiments.

And in case there's any doubt in your mind that a technological civilization is not "superior"—I don't say "happier"; that is of no moment in this discussion—note that a technologically equipped man can live in space, at the bottom of the ocean deeps, or defeat, without serious effort, any nontechnological attacker. In the utterly harsh, pragmatic terms of the Universe — Technological culture is superior.

I'm willing to bet that any technological culture we encounter anywhere in space, will have undergone that general sort of chastening experience.

It's the way to breed a superior race, without doubt.

But—does anyone want to set up that sort of thing as a deliberate "Eugenics" system?

THE EDITOR.

GET READY FOR THE SPACE and SCIENCE ERA! SEE SATELLITES, MOON ROCKETS CLOSE-UP

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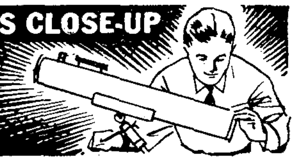
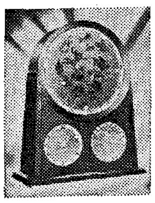


AUTOMATICALLY SHOWS TIME, TIDES, POSITION OF SUN, MOON, STARS



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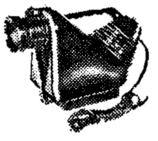

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Projects illustrations up to 3" x 3½" and enlarges them to 35" x 30" if screen is 6½ ft. *from projector;* larger pictures if screen is further away. No film or negatives needed. Projects charts, diagrams, pictures, photos, lettering in full color or black-and-white. Operates on 115 volt, A.C. current. 6-ft. extension cord and plug included. Operates on 60 watt bulb, not included. Size 12" x 8" x 4½" wide. Weight 1 lb., 2 oz. Plastic case with built-in handle.

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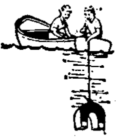

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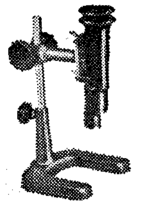

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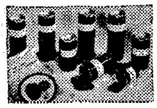

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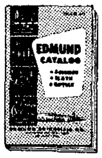

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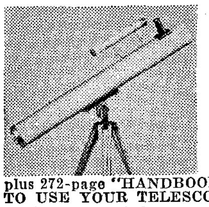

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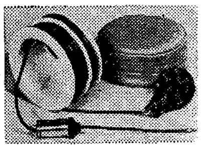

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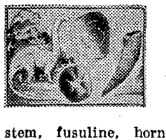

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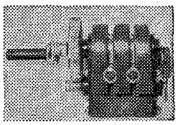

Brand new Signal Corps Electric Generator for scientific experiments, electrical uses, demonstrations. Generates up to 90 volts by turning crank. Use in high impedance relays. Charge ground and bring up night crawlers for bait or study. 2 Alnico Magnets alone worth original price. Wt. 2 lbs. Cost to Govt. $15.

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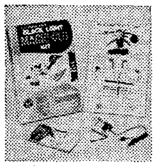

With this Kit, you can collect fluorescent rocks, paint with living light, write secret messages, learn invisible detection methods, even make a fluorescent Christmas tree! Kit uses longwave blacklight, which is completely harmless to eyes, but causes fluorescence in over 3,000 substances. Includes Magic Glow Lamp, universal laboratory lamp stand, invisible water paints and ink, fluorescent crayon, tracer powder, pen, 3 brushes, specimens of fluorescent rocks: wernerite from Canada, fluorite from England, willemite from U.S.A. Plus book of 40 experiments.

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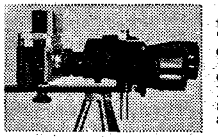

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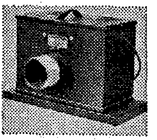

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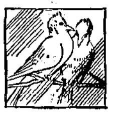

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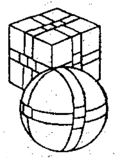

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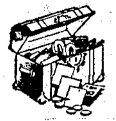

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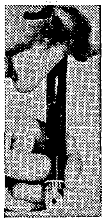

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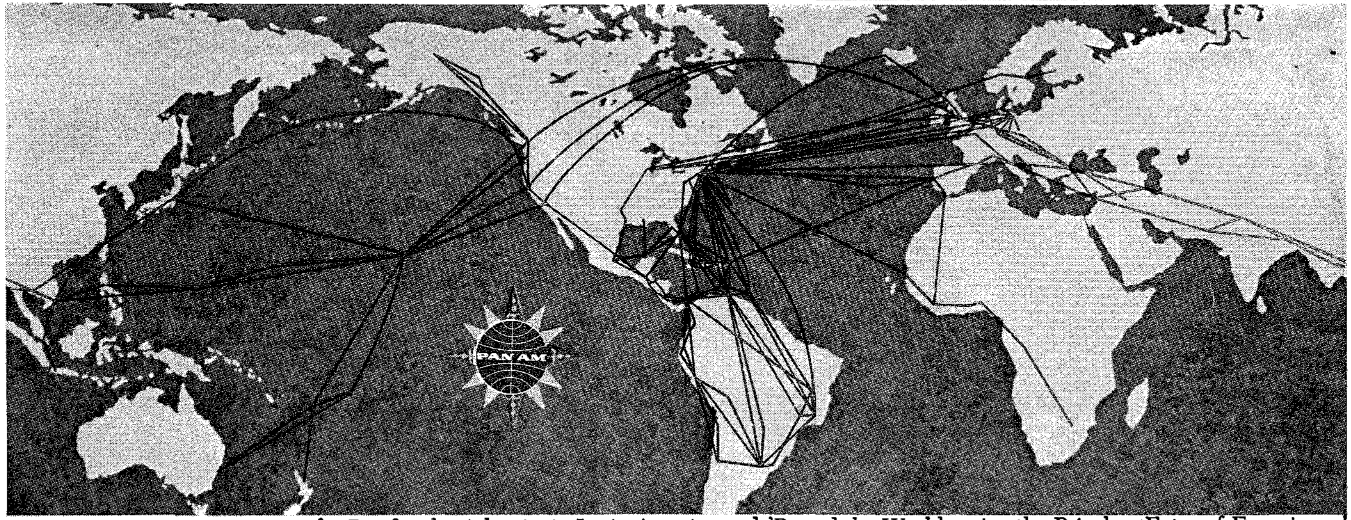

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